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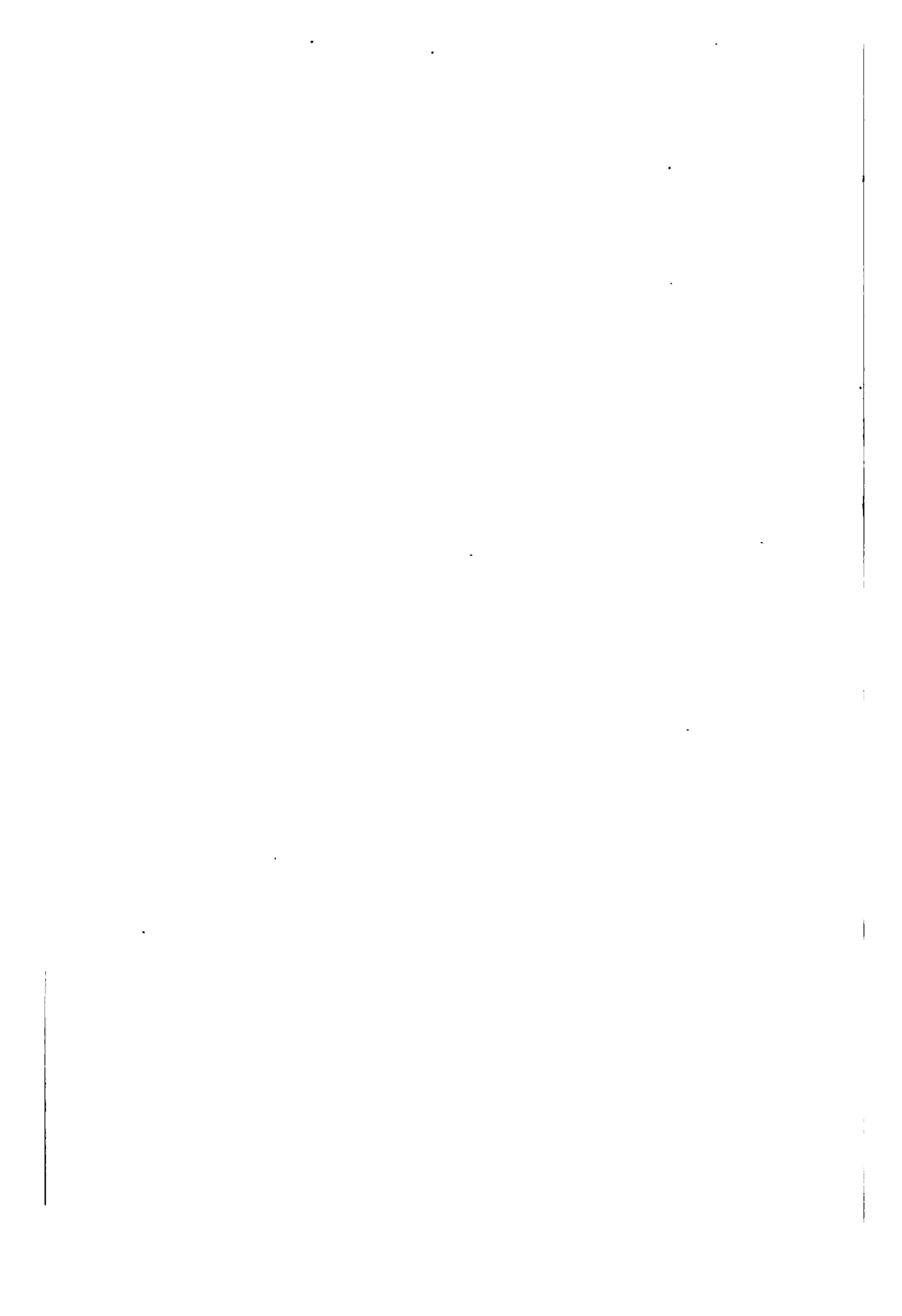
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HYDRAULIC AND OTHER TABLES

HYDRAULIC AND OTHER TABLES

FOR PURPOSES OF

SEWERAGE AND WATER-SUPPLY

BY

THOMAS HENNEL

M. INST. C.E.

SECOND EDITION, REVISED



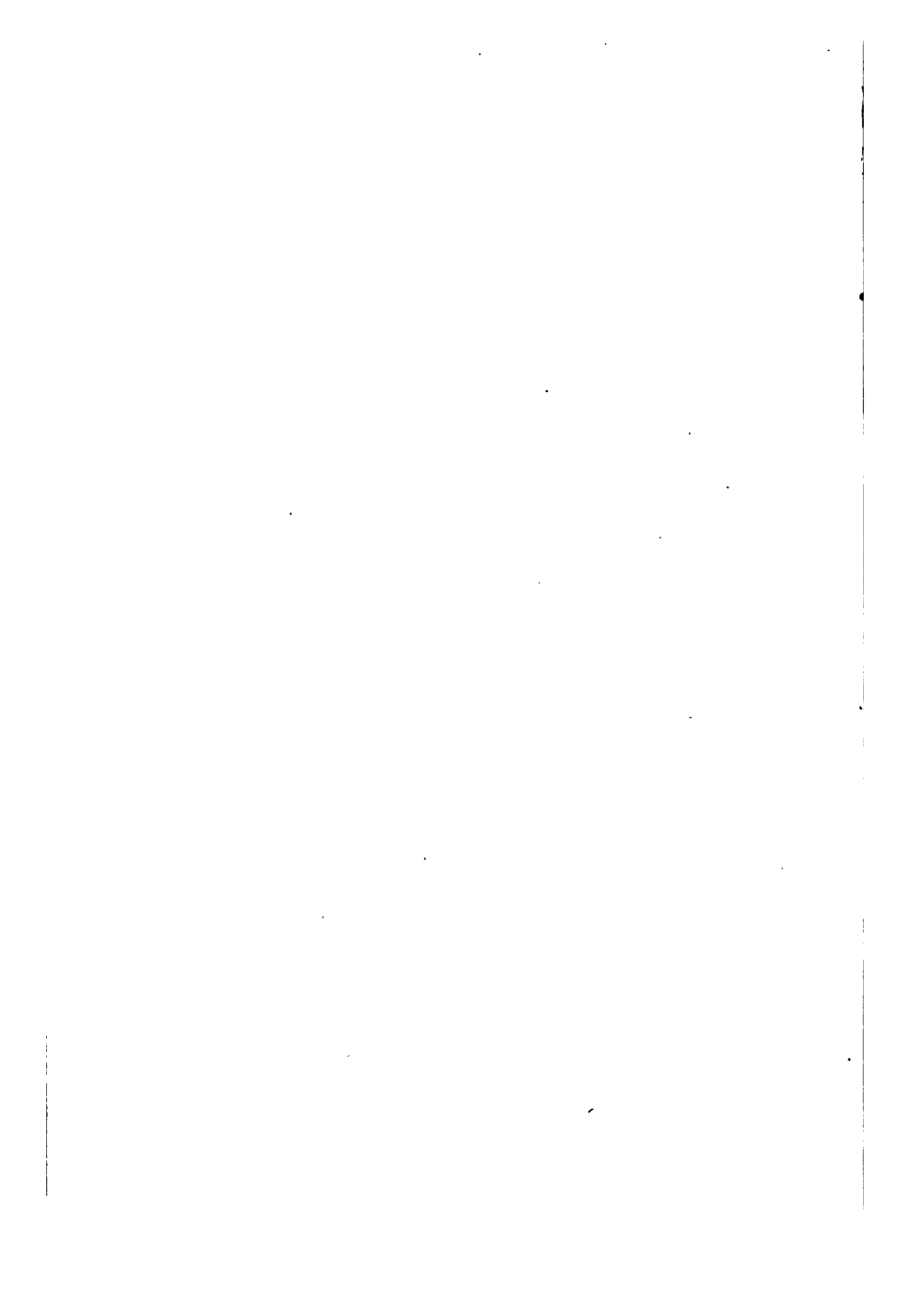
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PREFACE TO SECOND EDITION.

THE First Edition of the Tables having become exhausted, the Author has thought it only right, before reprinting, to bring some parts of the work more nearly up to date.

For that purpose he has entirely rewritten Tables X., XI., XII. and XV., relating to Rainfall and Analysis of Water, availing himself for that purpose of more recent observations and researches; and the Introductory Remarks have been altered in accordance.

The subject of Flow in Pipes and Channels has been investigated by numerous authorities, both mathematicians and engineers, during the past seventeen years, and many series of experiments have been made under varying circumstances.

No formula has, however, yet been arrived at which can be universally accepted as superseding that on which the Tables are based, and the Author does not think any apology necessary for reproducing them as they are.

He has, however, endeavoured in the Introductory Chapter to make some comparison between them and the results obtained by other methods, and so to indicate more fully than he did before the limits within which they should be relied on for practical use.

6 DELAHAY STREET, WESTMINSTER.
February, 1901.

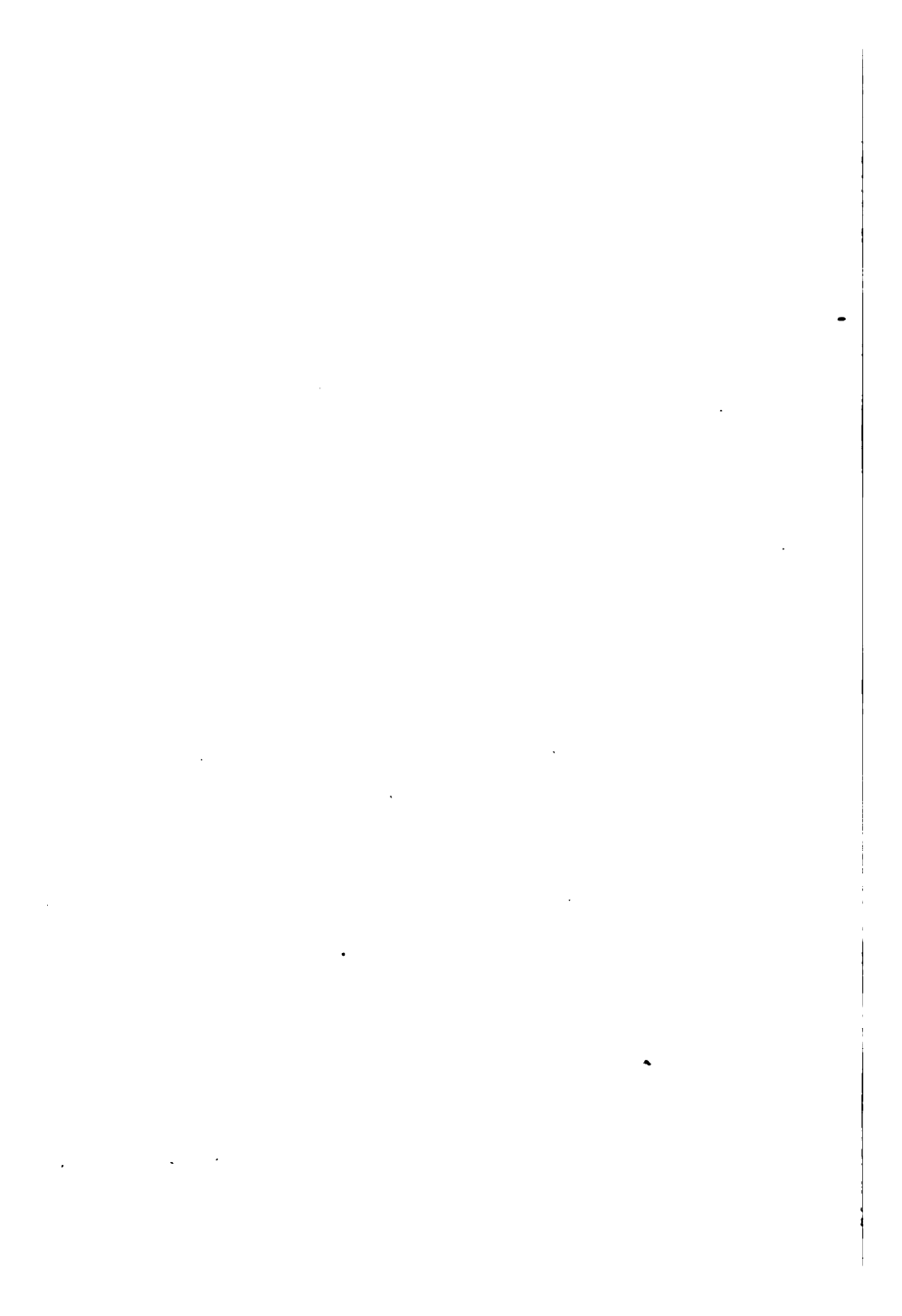
PREFACE.

It has been found that the Engineering Pocket Books in most general use give comparatively little information relating to Sewerage and Water Supply. And even the large and valuable works of the late Mr. Beardmore and others contain somewhat abridged Tables applicable to the calculations most frequently required in designing and carrying out works of moderate size.

The Tables in this book have been calculated from time to time by the author to meet his own requirements. Thinking it probable that other engineers will have experienced the same want as himself, he has now been induced to make them public. The greater part have been used in manuscript for some years; but a few additional Tables have been recently added in order to make the work more complete.

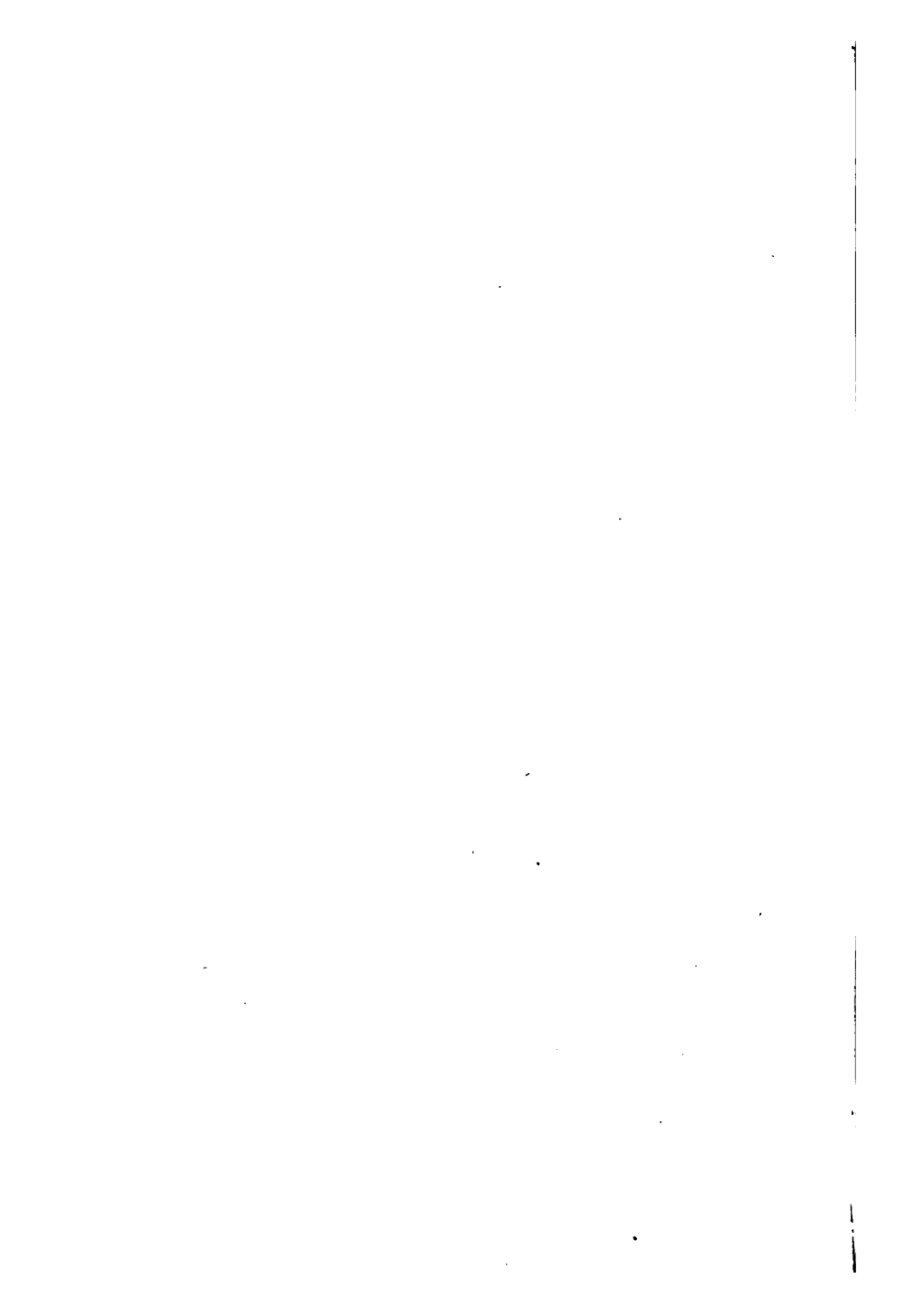
Every precaution has been taken, as far as possible, to guard against errors both in the calculations and printing. If however, notwithstanding, any mistakes should be discovered, the author will be greatly obliged by having them pointed out to him.

6, DELAHAY STREET, WESTMINSTER,
November 1883.



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DESCRIPTION AND REMARKS ON

THE

USE OF THE TABLES.



TABLES I. and II. show the quantities of water in gallons per foot contained in pipes, wells, tanks, &c., of given dimensions, and require no explanation.

TABLES III. and IV. give the discharge in gallons per minute of water passing through sluices and over weirs under ordinary conditions. Correction is required in case of bell-mouthed or specially formed orifices, and also where there is any considerable velocity of current in approaching the outlets; but the notes at the heads of the Tables, to which attention should be directed, will enable this to be made with sufficient accuracy for most practical purposes.

TABLE V. shows the velocity and discharge under varying conditions of flow in circular sewers and conduits, from 9 inches to 6 feet in diameter.

In designing and carrying out sewerage works, it is important to know not only the maximum carrying

capacity of the sewers, but also the effect produced by the much smaller quantity which will be generally flowing through them. This is essential in order to ascertain whether flushing will be required, and if so, what quantity of water will be needed for the purpose. The Table consequently shows, not only the maximum discharge and velocity of each kind of sewer under the most favourable circumstances, but also the discharge and velocity of the same sewers when full to one-half, one-quarter, and one-eighth only of their heights respectively. If a sewer should at any time run quite full, its discharge will be somewhat less than that indicated in the fourth column, the velocity of current being in that case considerably diminished by friction against the top. With any circular conduit the velocity when full is exactly the same, and the discharge just double that when half-full; the precise figures for a sewer running full may therefore be ascertained, if required, from the third column of Table by doubling the discharge.

A velocity of 150 feet per minute, or $2\frac{1}{2}$ feet per second, is generally considered sufficient to remove all obstacles of the ordinary character found in sewers. The quantity of water required to produce this velocity in each case is given in the last column

of the same Table, and will be found especially useful in designing flushing arrangements.

TABLE VI. gives precisely similar information for egg-shaped sewers, as Table V. for circular sewers.

TABLE VII. gives the discharge of pipes from $\frac{3}{8}$ -inch to 3 feet diameter, when running full at various inclinations or pressures. It should be remembered that the velocity of water passing through a line of pipes of any considerable length depends not on the inclination of any particular section, but on the hydraulic gradient throughout, or ratio of head of water to length of pipe; the "head" being the difference of level between the surface at or above the upper end of the pipe, and that of the cistern or pond into which it delivers, or if it has a free outlet, the lower end of the pipe itself. This velocity, except for slightly increased friction at bends, is entirely independent of the course of the pipes, whether laid at a uniform inclination or otherwise, also whether commencing at or below the upper surface and discharging, if not freely, at or below the lower surface.

The formula which has been used in the calculations for Tables V., VI. and VII. is that

known as Eytelwein's:—Velocity in feet per second = $94.25 \sqrt{S}$, where R is the so-called "hydraulic mean depth," i.e. the sectional area divided by the surface in contact, and S the slope or inclination expressed fractionally, e.g. $\frac{1}{100}$ or $\frac{1}{250}$.

The constant number 94.25 has, of course, been arrived at as the result of experiments made from time to time in different kinds of pipes and channels with varying inclinations.

It has, however, long been known that this formula gives generally too high results for small pipes, and too low results for larger pipes and channels; and many other and more complicated formulæ have been from time to time devised in order to accord more nearly with more recent actual observations and experiments.

In addition to the alterations of flow due to the size, shape and inclination of channels, there is also considerable variation caused by the nature of the surface in contact with the water, in what degree it is smooth or rough.

The following Table gives some idea of the varying results that would be arrived at by using the coefficients or formulæ of different observers; the figures given being those which they would in each case substitute for the constant 94.25 used in the

Tables. When two figures are given, the difference is due to difference of inclination within moderate limits.

Diam. of Pipe running full or half-full.	Darcy.			Kutter.	Professor Unwin.			Tables.
	For Clean Iron Pipes.	For Rusted Iron Pipes.	Mean	For Iron Pipes in Fair Condition.	For Clean Iron Pipes.	For In- crusted Pipes.	Mean	
2 in.	93	66	79	49.5 to 49				94.25
3 "	98	69	83	57 " 55				
6 "	105	74	89	71 " 69	108 to 104	72	89	
12 "	109	77	93	87 " 85	112 " 109	76	93	
18 "	110	78	94	96 " 94	116 " 113	78	96	
2 ft.	111	79	95	103 " 101	120 " 116	81	99	
3 "	111.5	79	95	111 " 109	124 " 120	83	102	
4 "	112	80	96	118 " 116	128 " 124	85	105	

It will be seen that, according to all the observations, the Tables will give correct results for pipes of a medium size, and too low results for larger ones; excepting only in the case of incrustated iron pipes, for which the Tables are too high, even with the largest size.

Kutter's figures are calculated from a very elaborate formula,* containing a coefficient which may be

$$* \text{ Velocity in feet per second} = \frac{\sqrt{R}}{n} \frac{M + 1.811}{M + \sqrt{R}}, \text{ where}$$

$$M = n \left(41.6 + \frac{.00281}{S} \right), \text{ and } n \text{ for ordinary pipes} = .013.$$

In order to ascertain with facility the discharge of pipes from 2 to 48 inches in diameter, at varying inclinations, in accordance with this formula, Messrs. E. B. & G. M. Taylor have drawn and published a set of diagrams to a large scale showing curves from which they can be read off by inspection.

varied for different kinds of material, but the figures in the column above are those considered applicable to ordinary cast or wrought iron pipes, or to sewers or culverts of good brickwork or unglazed stoneware. For coated or enamelled iron pipes, or for glazed stoneware pipes, Kutter would use a multiplier giving somewhat higher figures.

As, however, sewers constructed of glazed pipes have necessarily joints not more than 3 feet apart and somewhat irregular, the Author is of opinion that they should be classed with ordinary rather than with specially smooth or enamelled pipes, and that, so far as Kutter's formula is correct, the figures in the Table should apply generally to sewers also.

The Author has himself experimented on the velocities in long lengths of a glazed pipe sewer 2 feet in diameter, running a third to a quarter full, at various inclinations, and has found that the formula on which the Tables are based, gives fairly accurate results in all cases. But when he had made similar trials in a 5-foot sewer, he found the Tables considerably too low. He has not had the opportunity of testing pipes running full, but as the water flowing in a 2-foot sewer one-third deep has the same hydraulic mean depth as that of a 15-inch sewer running full, he would conclude that in that

case also the Tables would be correct, although for sizes larger than 15 inches somewhat too low. This agrees approximately with Kutter.

With reference to pipes under 2 inches in diameter, both Darcy's and Kutter's coefficients would make the figures given in Table VII. much too high, but a series of experiments on lead pipes by Professor Osborne Reynolds showed them in fact only a little high, whereas another formula, Neville's,* makes them in some cases too low.

For pipes of this kind, whether iron or lead, in straight lines of considerable length, and known to be in perfect condition, the Author—on consideration of all the evidence so far recorded—would be disposed to make a small deduction from the Tables, say about 5 per cent. for one inch, and 10 per cent.

* Neville's formula, which has been largely used, and on which are based the Tables of Flow contained in Huret's and Molesworth's Pocket-Books, is difficult to compare with others, as it shows the velocity composed of two parts, one proportional to the square roots, and the other to the cube roots, of the hydraulic mean depth and inclination. Thus, velocity in feet per second $= 140 \sqrt{RS} - 11 \sqrt[3]{RS}$. This formula makes the flow in small pipes with considerable fall larger instead of smaller than the Tables—in fact, makes the Tables too low for $\frac{1}{2}$ -inch pipes steeper than 1 in 50, for 1-inch pipes steeper than 1 in 100, 3-inch steeper than 1 in 250, 6-inch steeper than 1 in 500, 12-inch steeper than 1 in 1250, 24-inch steeper than 1 in 3000, and for larger sizes, whatever the inclination, the greatest difference for 36-inch pipes being about 17 per cent. But for flatter gradients the Tables for all the smaller sizes are, according to this formula, too high.

for $\frac{1}{2}$ -inch diameters. But pipes of these dimensions as generally used for house services and similar purposes, are subject to so many irregularities, such as sharp bends, angles, contractions or other obstacles to flow, that a much greater deduction is, in practice, really always necessary. In fact, a better approximation to the actual discharge could generally be arrived at by calculating from a smaller diameter of pipe—say, by taking the mean between the figure in the Table for the required diameter, and that for the next size lower.

For iron pipes exceeding 3 inches diameter, if of the best kind, coated inside, or quite new and perfect, the Author would suggest an addition to the figures contained in Tables, varying generally from 5 per cent. for 6-inch to 15 per cent. for 36-inch diameters.

But for iron pipes not so good in condition, and generally for stoneware pipes or sewers running full or half-full, he would consider the Tables correct for diameters of either 12, 15 or 18 inches, according to circumstances; for smaller sizes than these he would make a small deduction, and for larger sizes an addition of about 5 per cent. for each foot in diameter.

As to flow in pipes and sewers running less than half-full, no general rule can be given applicable to varying depths and forms of section, without first

calculating the hydraulic mean depth; but it may be remarked that the hydraulic mean depth of a circular sewer running a quarter full will be approximately the same as that of one a little more than half the size half full, and that of one running an eighth full approximately the same as one of a little more than a quarter the size half full. But where sewage, not clear water, is the material to be dealt with, it is obvious that the flow in small pipes, or shallow channels, cannot be calculated with accuracy, as deposit on the sides and bottom may reduce the sectional area at any point very considerably.

TABLE VIII. is intended to assist in designing the capacity of sewers, and shows at a glance the quantity of sewage, irrespective of rain and surface water, which should be allowed for given populations. In certain cases (see note at foot of Table), the allowance for rain may also be calculated on the basis of population with the help of the last column of the Table, but under ordinary circumstances this should be taken in proportion to area, as shown by Table IX. next following.

TABLE IX. shows the quantity of water due to rainfall over given areas, and the quantities in gallons

per minute, when running off at different rates of flow. The latter columns of the Table are intended for calculating the capacity of sewers ; and the second and third columns for estimating the quantity of water that can be collected from areas and gathering grounds for irrigation or water supply. The areas dealt with range from 100 square feet (representing the roof of a small building) to one square mile.

TABLES X., XI., XII., are rainfall Tables, for the information contained in which the Author is indebted to Mr. H. Sowerby Wallis, who succeeded the late Professor Symons as the recorder of British Rainfall.

TABLES XIII. and XIV. are intended to facilitate the preparation of preliminary reports and rough estimates for works of water supply, and show the approximate dimensions of reservoirs, filter beds, main pipes, pumping machinery, &c., required for the supply of given populations. It is not of course asserted that the constant numbers assumed in the headings of the columns are universally applicable ; and some few, e.g. 100 feet lift to be pumped, are necessarily arbitrary. But the differences due to

variations in these conditions can be ascertained generally either by inspection or by a short calculation, and results may be thus arrived at with much greater facility than if the Tables were not available.

TABLE XV. gives results of analyses of potable waters. To engineers and others, not constantly or very frequently engaged in investigating the quality of water, the figures presented by an analysis convey little information without some readily available standard of comparison. This it is endeavoured to afford by means of this Table, which contains the results of analyses of well-known waters from nearly every description of source.

For many of these the Author is indebted to Dr. Voelcker; others are from analyses by Messrs. Dibdin, Campbell, Thresh, and other well-known chemists.

TABLES XVI. and XVII. give the quantities of brickwork per yard in sewers, culverts, &c., and require no explanation.

TABLE XVIII. gives the weight per yard of cast-iron pipes adapted to different pressures of water. These weights have been arrived at not by theoretical

calculation, but by a careful comparison of the specifications and recent practice of experienced engineers. They agree, however, nearly with the calculated strengths as given by Mr. Box in his Hydraulic Tables. The weights for various safe heads found in Table 14 of Beardmore's 'Manual of Hydrology,' are certainly insufficient according to recent practice.

TABLE XIX. gives the weights per yard of lead service pipes of five different qualities as described in the note appended to the Table.

TABLE I.—QUANTITY of WATER contained in PIPES, WELLS, and CIRCULAR TANKS, per foot in length or depth.

Diam.	Contents.	Diam.	Contents.	Diam.	Contents.	Diam.	Contents.
inches.	gals. per foot	ft. in.	gals. per foot	feet.	gals. per foot	feet.	gals. per foot
$\frac{3}{4}$	·005	1 9	15 0	11	594	90	39,758
$\frac{1}{2}$	·008	2 0	19·6	12	7·7	100	49,088
$\frac{3}{8}$	·019	2 3	24·8	13	829	110	59,396
1	·034	2 6	30·7	14	962	120	70,685
$1\frac{1}{2}$	·076	2 9	37·1	15	1,104	130	82,956
2	·135	3 0	44·2	16	1,256	140	96,211
$2\frac{1}{2}$	·212	3 3	51·8	17	1,418	150	110,447
3	·305	3 6	60·2	18	1,590	160	125,664
4	·54	3 9	69·0	19	1,772	170	141,862
5	·85	4 0	78·5	20	1,963	180	159,044
6	1·22	4 6	99·4	25	3,068	190	177,206
7	1·66	5 0	122·7	30	4,418	200	196,350
8	2·17	5 6	148·5	35	6,013	250	306,796
9	2·75	6 0	176·7	40	7,854	300	441,788
10	3·39	6 6	207·4	45	9,940	350	601,322
11	4·12	7 0	240·5	50	12,272	400	785,400
12	4·91	7 6	276·1	55	14,850	500	1,227,190
13	5·75	8 0	314·2	60	17,671	600	1,767,150
14	6·67	8 6	354·7	65	20,740	700	2,405,290
15	7·67	9 0	397·6	70	24,053	800	3,141,600
16	8·72	9 6	443·0	75	27,611	900	3,975,750
18	11·04	10 0	490·9	80	31,416	1000	4,908,750

TABLE II.—QUANTITY of WATER contained in SQUARE CISTERNS OF TANKS, per foot in depth.

Length of Side.	Contents.	Length of Side.	Contents.	Length of Side.	Contents.	Length of Side.	Contents.
ft. in.	gals. per foot	ft. in.	gals. per foot	feet	gals. per foot	feet	gals. per foot
1 0	6·25	6 0	205	25	3,906	90	50,625
1 6	14·06	7 0	306	30	5,625	100	62,500
2 0	25·00	8 0	400	35	7,756	125	156,250
2 6	39·06	9 0	506	40	10,000	150	140,625
3 0	56·25	10 0	625	45	12,656	200	250,000
3 6	77·56	11 0	756	50	15,625	300	562,500
4 0	100·00	12 0	900	60	20,500	400	1,000,000
4 6	126·56	15 0	1,406	70	30,625	500	1,562,500
5 0	156·25	20 0	2,500	80	40,000	1000	6,250,000

TABLE III.—FLOW OF WATER through SLUICES and OPENINGS.

NOTE.—The "Head of Water" in the Table must represent the depth from the surface to the centre of the opening; or if the opening be submerged, then the difference of level between the surfaces above and below.

If the opening be bell-mouthed, or be a sluice having curved side walls properly tapering inwards to the narrowest part, the discharge will be greater than that shown by the Table, to the extent of, in case of the best form of opening, about 50 per cent.

Head of Water.		Discharge per Square Foot in Area of Opening.	Head of Water.		Discharge per Square Foot in Area of Opening.	Head of Water.		Discharge per Square Foot in Area of Opening.	Head of Water.		Discharge per Square Foot in Area of Opening.	Head of Water.		Discharge per Square Foot in Area of Opening.	Head of Water.		Discharge per Square Foot in Area of Opening.
ft.	in.	gals. per minute	ft.	in.	gals. per minute	ft.	in.	gals. per minute	ft.	in.	gals. per minute	ft.	in.	gals. per minute	ft.	in.	gals. per minute
	1	382	2	3	2,813	8	3	5,385	16	6	7,616						
	1	541	2	6	2,964	8	6	5,466	17	0	7,731						
	1	663	2	9	3,110	8	9	5,546	17	6	7,844						
	2	765	3	0	3,248	9	0	5,625	18	0	7,956						
	2	856	3	3	3,379	9	3	5,702	18	6	8,064						
	3	937	3	6	3,507	9	6	5,779	19	0	8,173						
	3	1,014	3	9	3,631	9	9	5,854	19	6	8,280						
	4	1,082	4	0	3,751	10	0	5,929	20	0	8,385						
	5	1,210	4	3	3,865	10	3	6,004	21	0	8,590						
	6	1,326	4	6	3,977	10	6	6,075	22	0	8,796						
	7	1,432	4	9	4,086	10	9	6,148	23	0	8,991						
	8	1,530	5	0	4,192	11	0	6,219	24	0	9,184						
	9	1,624	5	3	4,295	11	3	6,288	25	0	9,375						
	10	1,712	5	6	4,398	11	6	6,358	26	0	9,558						
	11	1,794	5	9	4,495	11	9	6,427	27	0	9,744						
	1	0	6	0	4,592	12	0	6,495	28	0	9,920						
1	1	1,951	6	3	4,687	12	6	6,628	30	0	10,269						
1	2	2,025	6	6	4,779	13	0	6,759	32	0	10,605						
1	3	2,096	6	9	4,872	13	6	6,888	34	0	10,933						
1	4	2,165	7	0	4,960	14	0	7,015	36	0	11,253						
1	5	2,231	7	3	5,048	14	6	7,139	38	0	11,557						
1	6	2,296	7	6	5,135	15	0	7,262	40	0	11,857						
1	9	2,480	7	9	5,219	15	6	7,382	45	0	12,577						
2	0	2,651	8	0	5,302	16	0	7,502	50	0	13,256						

TABLE IV.—FLOW OF WATER OVER WEIRS.

NOTE.—The "Depth" must represent difference in level between the sill of the weir and the surface of still water above it. If the water approaches the weir with a current having a perceptible velocity, the discharge will be greater than that shown by the Table to an extent depending on the velocity; a velocity of 2 feet per second will be equivalent generally to about half an inch, and a velocity of 3 feet per second to about three-quarters of an inch additional depth.

Depth.	Discharge per Inch in Width.	Depth.	Discharge per Inch in Width.	Depth.	Discharge per Inch in Width.	Depth.	Discharge per Inch in Width.
inches	gals. per min.	inches	gals. per min.	inches	gals. per min.	ft. in.	gals. per min.
$\frac{1}{8}$	334	$4\frac{1}{8}$	22·37	$10\frac{1}{8}$	87·5	2 1	334
$\frac{1}{6}$	467	$4\frac{1}{4}$	23·39	$10\frac{1}{4}$	90·8	2 2	354
$\frac{1}{5}$	613	$4\frac{3}{8}$	24·44	$10\frac{3}{8}$	94·1	2 3	374
$\frac{1}{4}$	944	$4\frac{1}{2}$	25·49	11	97·4	2 4	395
$\frac{3}{8}$	1·329	$4\frac{5}{8}$	26·56	$11\frac{1}{8}$	100·7	2 5	417
$\frac{1}{2}$	1·734	$4\frac{3}{4}$	27·64	$11\frac{1}{4}$	104·1	2 6	439
$\frac{5}{8}$	2·185	$4\frac{7}{8}$	28·74	$11\frac{3}{8}$	107·5	2 7	461
1	2·670	5	29·85	12	111·0	2 8	483
$1\frac{1}{8}$	3·185	$5\frac{1}{8}$	30·97	$12\frac{1}{8}$	118·0	2 9	506
$1\frac{1}{4}$	3·818	$5\frac{1}{4}$	32·12	13	125·1	2 10	529
$1\frac{1}{3}$	4·305	$5\frac{1}{2}$	33·26	$13\frac{1}{2}$	132·5	2 11	553
$1\frac{1}{2}$	4·905	$5\frac{3}{4}$	34·44	14	139·8	3 0	577
$1\frac{5}{8}$	5·531	$5\frac{7}{8}$	35·62	$14\frac{1}{2}$	147·4	3 1	601
$1\frac{3}{4}$	6·167	$5\frac{3}{4}$	36·85	15	155·1	3 2	625
$1\frac{7}{8}$	6·855	$5\frac{1}{2}$	38·02	$15\frac{1}{2}$	163·0	3 3	650
2	7·552	6	39·24	16	170·9	3 4	675
$2\frac{1}{8}$	8·27	$6\frac{1}{8}$	41·72	$16\frac{1}{8}$	179·0	3 5	701
$2\frac{1}{4}$	9·01	$6\frac{1}{4}$	44·25	17	187·1	3 6	727
$2\frac{1}{3}$	9·77	$6\frac{3}{8}$	46·82	$17\frac{1}{2}$	195·5	3 7	753
$2\frac{1}{2}$	10·55	7	49·45	18	203·9	3 8	779
$2\frac{5}{8}$	11·36	$7\frac{1}{8}$	52·12	$18\frac{1}{2}$	212·3	3 9	806
$2\frac{3}{4}$	12·18	$7\frac{1}{4}$	54·84	19	221·1	3 10	833
$2\frac{7}{8}$	13·02	$7\frac{3}{8}$	57·61	$19\frac{1}{2}$	229·8	3 11	860
3	13·87	8	60·41	20	238·8	4 0	888
$3\frac{1}{8}$	14·75	$8\frac{1}{8}$	62·54	$20\frac{1}{8}$	247·6	4 1	915
$3\frac{1}{4}$	15·64	$8\frac{1}{4}$	66·17	21	256·9	4 2	944
$3\frac{1}{3}$	16·55	$8\frac{3}{8}$	69·11	$21\frac{1}{2}$	265·9	4 3	972
$3\frac{1}{2}$	17·48	9	72·09	22	275·5	4 4	1000
$3\frac{5}{8}$	18·42	$9\frac{1}{8}$	75·12	$22\frac{1}{2}$	284·8	4 6	1060
$3\frac{3}{4}$	19·39	$9\frac{1}{4}$	78·18	23	294·4	4 8	1120
$3\frac{7}{8}$	20·37	$9\frac{3}{8}$	81·29	$23\frac{1}{2}$	303·9	4 10	1180
4	21·36	10	84·43	24	313·9	5 0	1240

TABLE V.—VELOCITY AND DISCHARGE PER MINUTE IN CIRCULAR SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
Diameter 9 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. ($\frac{1}{8}$ Inch.)		One-quarter. ($\frac{1}{4}$ Inch.)		One-half. ($\frac{1}{2}$ Inch.)		Seven-eighths. (Maximum Discharge.)		Discharge.		
	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.			
										feet	
1 in	20	264	300	58	420	225	550	600	1535	30	768
1 "	30	176	246	48	344	195	447	367	682	40	604
1 "	40	132	212	40	296	158	387	490	1245	60	852
1 "	50	105.8	190	37	266	143	346	475	1085	85	125
1 "	66	80	166	33	230	122	302	330	975	125	200
1 "	80	66	151	30	209	112	275	300	845	200	376
1 "	100	52.8	134	26	187	100	244	330	768	376	327
1 "	133	40	117	22	164	84	213	293	689	327	291
1 "	165	32	105	20	146	78	190	261	845	291	200
1 "	200	26.4	95	18	133	71	173	238	125	200	376
1 "	264	20	83	16	115	62	151	207	423	376	327
1 "	330	16	74	14	103	55	134	184	532	327	291
1 "	440	12	64	12	89	48	115	158	768	291	200
1 "	528	10	58	11	82	44	106	146	1085	200	376

VELOCITY AND DISCHARGE PER MINUTE IN CIRCULAR SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
Diameter 12 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.								Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. (1½ Inch.)		One-quarter. (3 Inches.)		One-half. (6 Inches.)		Seven-eighths. (Maximum Discharge.)		
	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	
	feet	gallons	feet	gallons	feet	gallons	feet	gallons	
1 in 30	284	98	396	380	520	1,275	565	2580	gallons
1 " 40	247	86	342	330	446	1,100	490	2335	"
1 " 50	220	76	303	292	400	980	438	2000	"
1 " 68	192	66	268	260	348	850	380	1730	"
1 " 80	173	60	248	235	316	725	346	1560	83
1 " 100	155	53	220	212	282	630	309	1410	45
1 " 133	135	46	188	181	246	600	270	1330	69
1 " 165	121	42	169	162	220	540	241	1100	96
1 " 200	110	38	151	145	200	490	219	1000	135
1 " 264	96	33	134	130	174	425	190	865	212
1 " 330	85	29	119	115	155	380	170	780	320
1 " 440	74	25	103	99	135	331	147	670	"
1 " 528	67	23	94	90	123	300	135	615	"
1 " 680	60	21	84	81	110	270	120	550	"

VELOCITY AND DISCHARGE PER MINUTE IN CIRCULAR SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.

Diameter 15 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. (1½ Inch.)		One-quarter. (3¼ Inches.)		One-half. (7½ Inches.)		Seven-eighths. (Maximum Discharge.)				
	Velocity. Discharge.		Velocity. Discharge.		Velocity. Discharge.		Velocity. Discharge.				
	feet	gallons	feet	gallons	feet	gallons	feet	gallons	gallons		
1 in 40	132	278	385	592	500	1900	547	3900	76		
1 " 60	105·6	250	342	526	446	1700	488	3480	106		
1 " 80	80	218	299	460	386	1470	438	3090	146		
1 " 80	66	196	272	418	352	1340	386	2760	225		
1 " 100	62·8	176	242	372	316	1204	346	2460	330		
1 " 132	40	153	211	525	274	1044	301	2140	567		
1 " 165	32	137	189	291	245	933	268	1910	..		
1 " 200	26·4	125	171	263	223	888	244	1737	..		
1 " 264	20	109	149	229	193	735	213	1516	..		
1 " 330	16	97	134	206	174	662	180	1350	..		
1 " 440	12	83	115	177	150	571	165	1175	..		
1 " 528	10	76	105	162	137	520	150	1068	..		
1 " 660	8	68	95	146	123	468	134	964	..		
1 " 880	6	60	82	126	105	400	116	824	..		

VELOCITY AND DISCHARGE PER MINUTE IN CIRCULAR SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
Diameter 18 Inches.

Inclination	Depth of Flow in Proportion to Height of Sewer.								Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. (2 1/8 Inches.)		One-quarter. (4 1/2 Inches.)		One-half. (9 Inches.)		Seven-eighths. (Maximum Discharge.)		
	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	
1 in 50	270	210	382	830	488	2684	536	5000	116
1 " 66	234	182	326	684	426	2380	466	4776	157
1 " 80	213	164	290	625	386	2120	433	4336	243
1 " 100	190	147	265	573	346	1903	379	3885	353
1 " 132	166	129	230	497	301	1655	330	3383	580
1 " 165	148	115	208	450	268	1474	295	3024	807
1 " 200	135	105	191	414	244	1342	268	2747	..
1 " 264	117	91	163	340	213	1171	233	2388	..
1 " 330	105	81	145	312	190	1046	209	2140	..
1 " 440	91	70	126	272	165	907	180	1845	..
1 " 528	82	63	116	260	150	825	165	1691	..
1 " 680	73	57	104	225	135	740	147	1507	..
1 " 880	65	50	89	192	116	640	127	1303	..
1 " 1056	58	45	81	170	106	585	116	1190	..

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.
Diameter 1 Foot 9 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 160 Feet per Minute.
	One-eighth. (34 Inches.)				One-quarter. (64 Inches.)		One-half. (104 Inches.)		Seven-eighths. (Maximum Discharge.)		
	Velocity.	Discharge.	Velocity.		Discharge.		Velocity.		Discharge.		
			feet.	gallons	feet.	gallons	feet.	gallons	feet.	gallons	
1 in 50	feet 292	gallons 306	406	1200	524	3830	693	8150	gallons ..		
1 " 66	80	266	354	1050	456	3420	608	7080	42		
1 " 80	68	241	322	950	414	3115	480	6440	58		
1 " 100	58.8	206	288	849	370	2775	411	5764	89		
1 " 133	40	179	251	740	322	2415	388	6013			
1 " 165	33	160	224	661	288	2160	390	4480	125		
1 " 200	26.4	146	203	599	262	1965	391	4074	167		
1 " 264	20	127	183	524	228	1710	353	3543	257		
1 " 330	16	113	119	462	204	1580	396	3163	375		
1 " 440	13	98	137	404	176	1320	196	2744	600		
1 " 538	10	89	125	369	161	1207	179	3508	830		
1 " 660	8	80	112	330	144	1080	160	3240	1270		
1 " 830	6	69	97	286	125	937	138	1933	..		
1 " 1056	5	63	89	263	114	855	136	1770	..		

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.
Diameter 2 Feet.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.		
		One-eighth. (3 Inches.)		One-quarter. (6 Inches.)		One-half. (1 Foot.)		Seven-eighths. (Maximum Discharge.)						
		Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1	in 66	270	370	378	1450	492	4820	638	9800	45	gallons			
1	" 80	246	338	344	1324	446	4370	490	8330	62				
1	" 100	220	301	307	1182	398	3900	438	8000	95				
1	" 122	191	262	284	1092	348	3410	381	6950	133				
1	" 165	171	234	239	920	311	3048	340	6300					
1	" 200	155	212	217	835	282	2764	309	5640	177				
1	" 264	135	185	189	728	246	2411	269	4900	274				
1	" 330	121	166	169	650	220	2156	241	4400	397				
1	" 440	105	145	146	562	190	1862	208	3900	630				
1	" 528	96	131	134	515	174	1705	190	3470	850				
1	" 690	85	116	119	458	155	1519	170	3100	1300				
1	" 880	74	101	103	396	134	1313	148	2700	..				
1	" 1056	68	93	95	366	123	1205	134	2435	..				
1	" 1320	60	82	84	323	110	1078	130	2300	..				

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.
Diameter 2 Feet 3 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
		One-eighth. (3¼ Inch.)		One-quarter. (6½ Inches.)		One-half. (1 Foot 1½ Inch.)		Seven-eighths. (Maximum Discharge.)		Velocity.	Discharge.	
		Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.			
feet per mile		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons	gallons
1 in	66	286	500	400	1950	520	6420	670	13,180	..	48	..
1 "	80	261	450	364	1772	473	5830	590	11,900	66	66	66
1 "	100	232	403	326	1587	423	5220	464	10,728	101	101	101
1 "	133	203	353	284	1383	368	4541	404	9,340	141	141	141
1 "	165	181	314	253	1232	329	4060	361	8,346	187	187	187
1 "	200	165	287	230	1120	298	3677	328	7,583	289	289	289
1 "	264	143	248	200	974	260	3205	285	6,589	419	419	419
1 "	330	128	222	179	872	233	2875	255	5,895	660	660	660
1 "	440	111	193	155	755	201	2480	221	5,109	880	880	880
1 "	528	102	177	142	691	184	2270	202	4,670	1340	1340	1340
1 "	660	92	160	126	614	164	2024	180	4,163	2250	2250	2250
1 "	880	78	135	109	531	142	1752	157	3,630	..	..	..
1 "	1056	71	123	100	487	130	1604	148	3,300	..	..	..
1 "	1320	64	111	89	433	116	1431	128	2,959	..	..	..

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.

Diameter 3 Feet 6 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 160 Feet per Minute.		
		One-eighth. (3/8 Inches.)		One-quarter. (1/2 Inches.)		One-half. (1 Foot 3 Inches.)		Seven-eighths. (Maximum Discharge.)						
		Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
		feet.	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1	in	66	302	650	422	2520	550	8420	602	17,150	42			
1	"	100	246	529	344	2067	447	6843	486	13,851	70			
1	"	133	214	460	299	1797	389	5955	426	12,141	106			
1	"	165	191	411	267	1505	347	5312	381	10,858	148			
1	"	200	174	374	243	1460	315	4823	345	9,832	197			
1	"	264	151	325	211	1268	275	4210	301	8,578	303			
1	"	330	135	290	189	1136	246	3766	269	7,666	430			
1	"	440	117	251	164	986	213	3251	233	6,640	690			
1	"	528	107	230	150	901	194	2970	213	6,070	900			
1	"	660	96	206	134	805	174	2664	180	5,415	1380			
1	"	830	82	176	115	691	150	2296	165	4,702	2270			
1	"	1066	75	161	105	631	137	2037	150	4,275	3500			
1	"	1330	68	146	94	565	123	1883	134	3,819	..			
1	"	1760	58	125	82	493	106	1630	116	3,320	..			

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.
Diameter 2 Feet 9 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 160 Feet per Minute.		
		One-eighth. ($\frac{1}{8}$ Inches.)		One-quarter. ($\frac{1}{4}$ in. less.)		One-half. (1 Foot $\frac{1}{4}$ Inches.)		Seven-eighths. (Maximum Discharge.)						
		Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1	in 66	316	822	444	3232	576	10,875	632	21,800	316	10,902	316	gallons	
1	" 100	258	671	360	2621	469	8,690	513	17,698	282	9,729	450	74	
1	" 133	224	582	313	2279	407	7,542	447	15,430	244	8,418	713	111	
1	" 165	200	520	280	2038	365	6,763	399	13,765	223	7,693	940	155	
1	" 200	183	476	255	1856	331	6,133	363	12,523	200	6,900	1420	207	
1	" 264	158	411	222	1616	288	5,337	316	10,902	173	5,970	2300	316	
1	" 330	142	369	198	1441	258	4,781	282	9,729	158	5,450	3300	450	
1	" 440	124	322	172	1252	223	4,132	244	8,418	141	4,864	..	713	
1	" 538	112	291	157	1143	203	3,761	223	7,693	129	4,864	..	940	
1	" 660	100	260	140	1019	182	3,374	200	6,900	111	4,210	..	1420	
1	" 880	87	226	121	881	158	2,928	173	5,970	100	4,210	..	2300	
1	" 1066	79	207	110	801	144	2,668	158	5,450	90	4,210	..	3300	
1	" 1320	71	185	99	753	129	2,390	141	4,864	80	4,210	..	..
1	" 1760	62	166	86	626	111	2,060	123	4,210	70	4,210	..	..

VELOCITY AND DISCHARGE PER MINUTE IN CIRCULAR SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.

Diameter 8 Feet.

Inclination.		Depth of Flow in Proportion to Height of Sewer.												Quantity required to give Velocity of 150 Feet per Minute.				
		One-eighth. (4 inches.)				One-quarter. (9 inches.)				One-half (1 Foot 6 inches.)					Seven-eighths. (Maximum Discharge.)			
		Velocity.		Discharge.	Velocity.		Discharge.	Velocity.		Discharge.	Velocity.		Discharge.		Velocity.		Discharge.	
		feet	gallons		feet	gallons		feet	gallons		feet	gallons			feet	gallons		feet	gallons
1 in	66	332	1027	462	3999	604	13,290	660	37,100	660	37,100	660	37,100	78				
1 "	100	269	832	378	3255	489	10,760	534	21,926	534	21,926	534	21,926	116				
1 "	132	40	235	283	2839	426	9,970	464	19,052	464	19,052	464	19,052	162				
1 "	165	32	210	284	2458	380	8,960	416	17,080	416	17,080	416	17,080	217				
1 "	200	26.4	190	588	2302	346	7,610	380	15,603	380	15,603	380	15,603					
1 "	264	20	166	514	1999	302	6,640	330	13,550	330	13,550	330	13,550	329				
1 "	330	16	148	458	207	268	5,900	298	12,154	298	12,154	298	12,154	468				
1 "	440	12	128	396	179	1543	5,060	256	10,500	256	10,500	256	10,500	738				
1 "	528	10	117	363	164	1419	4,660	232	9,528	232	9,528	232	9,528	1000				
1 "	660	8	104	322	146	1264	4,180	208	8,540	208	8,540	208	8,540	1460				
1 "	880	6	91	281	126	1091	3,630	181	7,432	181	7,432	181	7,432	2330				
1 "	1066	5	83	257	115	995	3,320	166	6,774	166	6,774	166	6,774	3300				
1 "	1320	4	74	229	103	891	2,950	148	6,055	148	6,055	148	6,055	..				
1 "	1760	3	64	198	89	770	2,530	128	5,255	128	5,255	128	5,255	..				

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.
Diameter 3 Feet 6 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 180 Feet per Minute.
		One-eighth. (64 Inches.)		One-quarter. (104 Inches.)		One-half. (1 Foot 9 Inches.)		Seven-eighths. (Maximum Discharge.)		Velocity.	Discharge.	
		Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.			
		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons	gallons
1	in 66	359	1508	501	5887	651	19,530	713	39,860	713	39,860	..
1	" 132	253	1062	355	4171	460	13,800	504	28,200	504	28,200	126
1	" 200	206	865	288	3384	374	11,220	404	23,600	404	23,600	235
1	" 264	179	752	251	2949	325	9,750	356	19,930	356	19,930	345
1	" 330	160	672	224	2632	291	8,730	319	17,850	319	17,850	504
1	" 440	139	584	194	2279	252	7,560	279	15,430	279	15,430	790
1	" 528	126	529	177	2080	230	6,900	252	14,100	252	14,100	1045
1	" 660	113	475	158	1856	206	6,180	225	13,690	225	13,690	1500
1	" 890	98	412	136	1598	178	5,340	195	10,900	195	10,900	2430
1	" 1056	90	378	125	1469	162	4,860	178	9,960	178	9,960	3360
1	" 1320	80	336	112	1316	145	4,350	159	8,900	159	8,900	5080
1	" 1760	69	290	97	1140	126	3,780	138	7,720	138	7,720	..
1	" 2112	63	265	88	1040	115	3,450	126	7,050	126	7,050	..
1	" 2640	56	235	79	980	103	3,090	113	6,390	113	6,390	..

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.

Diameter 4 Feet.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.		
		One-eighth. (6 Inches.)				One-quarter. (1 Foot.)		One-half. (2 Feet.)		Seven-eighths. (Maximum Discharge.)				
		Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1 in	68	384	2110	586	8240	695	27,240	764	55,780		gallons			
1 "	132	271	1490	372	5720	492	19,300	539	39,340		..			
1 "	200	220	1210	302	4640	400	15,680	438	31,970		245			
1 "	264	192	1055	268	4120	348	13,640	382	27,890		375			
1 "	330	171	940	238	3658	310	12,150	340	24,820		535			
1 "	440	148	814	204	3136	269	10,540	294	21,460		830			
1 "	528	134	737	186	2860	246	9,650	269	19,660		1100			
1 "	660	121	665	166	2550	220	8,620	241	17,600		1580			
1 "	880	105	577	146	2244	190	7,450	208	15,180		2530			
1 "	1056	96	528	134	2059	174	6,820	191	13,940		3500			
1 "	1320	86	473	119	1829	155	6,075	170	12,410		5100			
1 "	1760	74	407	102	1568	134	5,260	147	10,780		..			
1 "	2112	67	368	93	1430	123	4,825	135	9,830		..			
1 "	2640	60	330	83	1275	110	4,310	121	8,800		..			

VELOCITY AND DISCHARGE per MINUTE in CIRCULAR SEWERS, with Water flowing at various depths.
Diameter 5 Feet.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.		
		One-eighth. (7½ Inches.)				One-quarter. (1 Foot 3 Inches.)		One-half. (2 Feet 6 Inches.)		Seven-eighths. (Maximum Discharge.)				
		Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1 in	66	428	3680	600	14,400	776	47,300	853	87,180	..	..	gallons
1 "	80	302	2600	422	10,150	548	38,400	603	68,640	..	..	..
1 "	132	246	2115	342	8,220	446	27,180	498	55,680	..	..	..
1 "	200	214	1840	300	7,200	388	28,650	428	48,590	..	..	420
1 "	264	194	1670	268	6,430	348	21,210	380	43,320	..	..	590
1 "	330	166	1480	230	5,590	300	18,280	330	37,680	..	..	920
1 "	440	151	1300	211	5,075	274	16,700	301	34,320	..	..	1,220
1 "	528	136	1170	189	4,540	246	15,000	268	30,560	..	..	1,730
1 "	660	117	1000	164	3,945	213	12,980	233	26,450	..	..	2,800
1 "	890	107	920	150	3,600	194	11,820	213	24,300	..	..	3,600
1 "	1066									..	..	
1 "	1320	97	835	134	3,215	174	10,600	190	21,680	..	..	5,880
1 "	1760	83	715	115	2,765	160	9,140	166	18,860	..	..	9,040
1 "	2112	75	680	105	2,540	137	8,350	151	17,160	..	..	12,800
1 "	2640	68	585	90	2,270	123	7,500	134	15,376	..	..	..

VELOCITY AND DISCHARGE PER MINUTE IN CIRCULAR SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.

Diameter 6 Feet.

Inclination.	Depth of Flow in Proportion to Height of Sewer.								Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. (9 Inches.)		One-quarter. (1 Foot 6 Inches.)		One-half. (3 Feet.)		Seven-eighths. (Maximum Discharge.)		
	Velocity.		Discharge.		Velocity.		Discharge.		
	feet	gallons	feet	gallons	feet	gallons	feet	gallons	
1 in 66	468	5790	652	22,580	852	75,200	932	153,000	gallons
1 " 133	40	332	4110	16,000	602	53,120	680	108,400	..
1 " 200	26·4	270	3340	13,140	488	43,060	536	88,040	..
1 " 264	20	234	2895	11,290	426	37,600	466	76,500	455
1 " 330	16	210	2610	10,040	380	33,535	418	68,680	640
1 " 440	13	182	2250	8,720	330	29,120	360	59,130	980
1 " 528	10	166	2055	8,000	301	26,560	330	54,200	1,320
1 " 660	8	148	1830	7,200	270	23,880	294	48,880	1,890
1 " 880	6	129	1600	6,160	232	20,480	254	41,740	2,950
1 " 1056	5	117	1448	5,645	212	18,800	233	38,950	3,850
1 " 1320	4	105	1300	5,020	190	16,770	209	34,330	5,670
1 " 1760	3	91	1126	4,360	165	14,560	180	29,580	9,840
1 " 2112	2·5	83	1027	4,000	150	13,280	165	27,100	13,200
1 " 2640	2	74	917	3,600	135	11,915	147	24,140	..

TABLE VI.—VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
Sewer 2 Feet x 1 Foot 4 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 160 Feet per Minute.		
	One-eighth. (3 Inches.)				One-quarter. (6 Inches.)		One-half. (1 Foot.)		Seven-eighths. (Maximum Discharge.)				
	Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
	feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1 in 50	295	223	380	790	480	2720	595	6910	..	..	
1 " 66	257	196	331	686	417	2360	488	6440	..	..	
1 " 100	210	160	268	556	339	1921	381	4430	38	38			
1 " 132	183	139	234	486	295	1674	331	3850	60	60			
1 " 165	163	124	210	436	264	1496	297	3450	80	80			
1 " 200	148	112	190	395	240	1360	270	3138	120	120			
1 " 264	129	98	166	346	208	1180	234	2720	210	210			
1 " 330	116	88	148	305	186	1056	210	2440	330	330			
1 " 440	99	76	128	268	162	918	182	2115	620	620			
1 " 538	91	69	117	243	148	838	166	1925	920	920			
1 " 680	81	62	105	216	132	748	148	1725	..	..	
1 " 880	70	53	91	189	114	646	120	1490	..	..	
1 " 1056	64	47	83	172	104	590	117	1380	..	..	
1 " 1320	58	44	74	153	93	527	105	1230	..	..	

VELOCITY AND DISCHARGE per MINUTE in EGG-SHAPED SEWERS, with Water flowing at various depths.
Sewer 2 Feet 8 Inches \times 1 Foot 6 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 160 Feet per Minute.
		One-eighth. ($\frac{3}{8}$ Inches.)		One-quarter. ($\frac{1}{2}$ Inches.)		One-half. (1 Foot $\frac{1}{4}$ Inch.)		Seven-eighths. (Maximum Discharge.)		Velocity.	Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1 in	50	feet 312	gallons 300	feet 402	gallons 1054	feet 508	gallons 4480	feet 573	gallons 9400	gallons		
1 "	66	271	260	350	920	443	3900	497	7310	..		
1 "	80	221	212	285	747	360	3175	404	5940	41		
1 "	100	192	185	248	650	314	2770	353	5180	63		
1 "	132	172	167	222	582	280	2470	314	4620	85		
1 "	200	156	150	201	527	254	2240	286	4200	120		
1 "	264	135	130	176	460	222	1960	248	3650	210		
1 "	330	121	116	156	409	198	1750	222	3285	330		
1 "	440	105	101	136	356	172	1512	192	2824	610		
1 "	528	97	93	124	325	156	1380	176	2690	900		
1 "	660	86	83	111	290	140	1235	157	2310	2000		
1 "	880	74	71	96	250	121	1067	138	2000	..		
1 "	1056	68	65	88	230	111	980	124	1824	..		
1 "	1320	61	59	78	204	99	874	111	1633	..		

VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.

Sewer 2 Feet 6 Inches \times 1 Foot 8 Inches.

Inclination.		Depth of Flow in proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
		One-eighth. (3½ inches.)		One-quarter. (7¼ inches.)		One-half. (1 Foot 3 inches.)		Seven eighths. (Maximum Discharge.)				
		Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	
1 in	68	feet 280	gallons 338	feet 371	gallons 1203	feet 467	gallons 4138	feet 523	gallons 9600	feet 523	gallons 9600	gallons ..
1 "	100	226	272	301	972	369	3350	424	7700	424	7700	43
1 "	132	40	198	238	846	330	2924	369	6700	369	6700	65
1 "	165	32	176	214	764	296	2620	330	6000	330	6000	90
1 "	200	36.4	160	193	687	268	2375	300	5450	300	5450	125
1 "	264	20	140	169	601	233	2069	281	4750	281	4750	210
1 "	330	16	124	150	534	209	1852	235	4380	235	4380	335
1 "	440	12	108	131	463	180	1598	202	3670	202	3670	600
1 "	528	10	99	120	424	165	1462	185	3360	185	3360	890
1 "	680	8	88	107	382	148	1311	165	3000	165	3000	1500
1 "	880	6	77	93	328	128	1132	143	2600	143	2600	..
1 "	1056	5	70	84	300	117	1034	131	2380	131	2380	..
1 "	1320	4	62	74	266	105	926	118	2140	118	2140	..
1 "	1760	3	54	65	230	90	800	101	1894	101	1894	..

feet per mile

VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.

Sewer 2 Feet 9 Inches x 1 Foot 10 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.		
		One-eighth. (4½ Inches.)		One-quarter. (¾ Inches.)		One-half. (1 Foot 4½ Inches.)		Seven-eighths. (Maximum Discharge.)						
		Velocity.		Discharge.		Velocity.		Discharge.		Velocity.			Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1	in 66	300	432	387	1518	489	5230	560	12,060	560	12,060	gallons	..	
1	" 100	243	350	313	1230	402	4300	448	9,800	448	9,800	45		
1	" 132	212	305	274	1077	345	3690	389	8,560	389	8,560	70		
1	" 165	190	274	244	956	308	3300	348	7,720	348	7,720	100		
1	" 200	172	248	222	870	284	3040	316	6,950	316	6,950	130		
1	" 264	150	216	194	760	244	2610	274	6,090	274	6,090	215		
1	" 330	134	192	172	674	218	2333	246	5,400	246	5,400	345		
1	" 440	116	168	150	588	190	2033	214	4,700	214	4,700	588		
1	" 528	106	153	137	538	172	1840	194	4,270	194	4,270	880		
1	" 660	95	137	122	478	154	1650	174	3,860	174	3,860	1440		
1	" 880	82	118	106	411	133	1420	150	3,300	150	3,300	3300		
1	" 1066	75	108	97	380	122	1310	137	3,010	137	3,010	..		
1	" 1320	67	96	86	337	109	1166	123	2,700	123	2,700	..		
1	" 1760	58	84	75	294	95	1016	107	2,360	107	2,360	..		

D

VELOCITY AND DISCHARGE per MINUTE in EGG-SHAPED SEWERS, with Water flowing at various depths.
Sewer 3 Feet \times 2 Feet.

Inclination.		Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
		One-eighth. (44 Inches.)		One-quarter. (9 Inches.)		One-half. (1 Foot 6 Inches.)		Seven-eighths. (Maximum Discharge.)				
		Velocity.	Discharge	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	
		feet	gallons	feet	gallons	feet.	gallons	feet	gallons	feet	gallons	
1 in	66	313	540	404	1880	510	6500	674	14,900		gallons	
1 "	100	255	437	322	1504	414	5280	467	12,120		"	
1 "	132	221	380	286	1335	361	4600	407	10,650		73	
1 "	165	198	338	256	1200	324	4130	364	9,450		100	
1 "	200	180	309	228	1064	293	3735	330	8,670		133	
1 "	264	157	270	202	940	255	3250	286	7,450		215	
1 "	330	139	238	180	840	228	2910	257	6,680		350	
1 "	440	121	208	156	728	198	2525	223	5,770		590	
1 "	538	111	190	143	668	180	2300	203	5,270		870	
1 "	680	99	169	128	600	162	2065	189	4,735		1400	
1 "	880	86	147	111	517	140	1785	157	4,075		2800	
1 "	1066	78	135	101	470	128	1620	143	3,780		"	
1 "	1320	70	120	90	420	114	1455	128	3,340		"	
1 "	1760	61	105	78	364	99	1262	111	2,865		"	

VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
Sewer 3 Feet 3 Inches \times 2 Feet 2 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. ($\frac{1}{8}$ Inches.)		One-quarter. ($\frac{1}{4}$ Inches.)		One-half. (1 Foot $\frac{1}{4}$ Inches.)		Seven-eighths. (Maximum Discharge.)		Discharge.	Velocity.	
	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.			
1 in 66	326	655	421	2300	532	7975	598	18,240	gallons.	220	
1 " 100	294	531	341	1865	432	6475	490	14,935	"	350	
1 " 133	230	462	298	1630	376	5635	423	12,970	"	590	
1 " 165	207	416	266	1455	336	5040	378	11,580	"	865	
1 " 200	186	374	241	1320	304	4560	344	10,490	"	1390	
1 " 264	161	324	210	1150	266	3990	299	9,120	"	2700	
1 " 330	143	287	187	1023	238	3565	267	8,140	"	4550	
1 " 440	126	253	164	897	206	3090	232	7,075	"	..	
1 " 528	115	231	149	825	187	2800	211	6,435	"	..	
1 " 660	103	207	133	727	168	2520	189	5,765	"	..	
1 " 880	89	179	115	630	145	2170	163	4,940	"	..	
1 " 1068	81	163	105	574	133	1995	150	4,560	"	..	
1 " 1320	71	144	93	511	119	1785	133	4,065	"	..	
1 " 1760	63	127	82	448	103	1540	116	3,640	"	..	

D
B

VELOCITY AND DISCHARGE per MINUTE in Egg-SHAPED SEWERS, with Water flowing at various depths.
Sewer 3 Feet 6 Inches x 2 Feet 4 Inches.

Inclination.		Depth of Flow in Proportion to Height of Sewer.								Quantity required to give Velocity of 150 Feet per Minute.				
		One-eighth. (64 Inches.)				One-quarter. (104 Inches.)		One-half. (1 Foot 9 Inches.)			Seven-eighths. (Maximum Discharge.)			
		Velocity.		Discharge.		Velocity.		Discharge.			Velocity.		Discharge.	
		feet	gallons	feet	gallons	feet	gallons	feet	gallons		feet	gallons		
1 in	100	52.8	275	642	355	2260	448	7760	504	17,950	gallons			
1 "	132	40	240	560	300	1900	390	6760	440	16,680	..	80		
1 "	165	32	214	500	276	1740	350	6000	394	14,080	110			
1 "	200	26.4	195	455	251	1600	317	5490	357	12,700	140			
1 "	264	20	170	396	218	1370	275	4780	313	11,100	220			
1 "	330	16	152	355	196	1240	247	4280	278	9,900	355			
1 "	440	12	132	308	170	1080	215	3730	243	8,600	600			
1 "	528	10	120	280	154	950	195	3380	230	7,880	865			
1 "	660	8	107	250	138	870	175	3000	197	7,015	1380			
1 "	880	6	93	217	120	760	151	2620	170	6,060	2550			
1 "	1056	5	85	198	109	690	138	2390	157	5,500	4200			
1 "	1320	4	76	177	98	623	124	2140	139	4,960	..			
1 "	1760	3	66	154	85	540	108	1870	121	4,300	..			
1 "	2640	2	53	124	69	437	87	1500	98	3,510	..			

VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.

Sewer 4 Feet x 2 Feet 8 Inches.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 180 Feet per Minute.
	One-eighth. (6 Inches.)		One-quarter. (1 Foot.)		One-half. (2 Feet.)		Seven-eighths. (Maximum Discharge.)		gallons		
	Velocity.		Discharge.		Velocity.		Discharge.				
	feet	gallons	feet	gallons	feet	gallons	feet	gallons			
1 in 100	52.8	294	884	380	3150	479	10,850	537	25,000	360	
1 " 132	40	255	780	330	2740	417	9,440	468	21,760	610	
1 " 165	33	226	680	295	2450	372	8,420	420	19,500	860	
1 " 200	26.4	208	635	268	2220	339	7,675	380	17,670	1350	
1 " 264	20	181	550	234	1940	295	6,680	333	16,430	2500	
1 " 330	16	162	490	208	1725	264	5,980	297	13,800	4000	
1 " 440	12	140	430	180	1500	228	5,160	256	11,900	..	
1 " 598	10	128	390	165	1350	208	4,720	234	10,880	..	
1 " 680	8	113	340	148	1230	186	4,210	210	9,760	..	
1 " 880	6	99	300	128	1065	162	3,668	183	8,460	..	
1 " 1068	5	90	275	117	970	148	3,340	166	7,720	..	
1 " 1380	4	81	245	104	863	132	2,990	148	6,900	..	
1 " 1760	3	70	210	90	750	114	2,580	128	5,950	..	
1 " 2640	2	57	170	74	615	93	2,105	105	4,880	..	

VELOCITY AND DISCHARGE per MINUTE in EGG-SHAPED SEWERS, with Water flowing at various depths.
 Sewer 4 Feet 6 Inches \times 3 Feet.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 160 Feet per Minute.
	One-eighth. (6½ Inches.)		One-quarter. (1 Foot 1¼ Inch.)		One-half. (2 Feet 3 Inches.)		Seven-eighths. (Maximum Discharge.)		gallons		
	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.	Velocity.	Discharge.			
1 in 100	feet	gallons	feet	gallons	feet	gallons	feet	gallons	gallons		
1 " 133	314	1230	402	4300	508	14,540	570	38,500	..		
1 " 165	271	1050	350	3740	442	12,650	497	29,250	85		
1 " 200	240	925	314	3360	396	11,820	444	26,180	125		
1 " 264	223	860	284	3040	360	10,300	405	23,880	160		
1 " 330	192	740	248	2655	312	8,930	363	20,720	235		
1 " 440	172	664	222	2375	280	8,000	314	18,480	370		
1 " 528	148	572	192	2055	242	6,920	272	16,000	620		
1 " 660	136	525	175	1870	221	6,325	248	14,600	860		
1 " 880	120	463	157	1680	198	5,660	222	13,060	1350		
1 " 1100	105	405	136	1455	171	4,700	192	11,300	2400		
1 " 1320	96	372	124	1380	156	4,465	176	10,360	3550		
1 " 1560	86	334	111	1190	140	4,000	157	9,240	6100		
1 " 1760	74	286	96	1030	121	3,460	136	8,000	..		
1 " 2640	60	232	78	840	99	2,834	111	6,530	..		

**VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
SEWERS 5 FEET X 3 FEET 4 INCHES.**

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.	
	One-eighth (7½ Inches.)		One-quarter. (1 Foot 3 Inches.)		One-half (2 Feet 6 Inches.)		Seven-eighths. (Maximum Discharge.)					
	Velocity. Discharge.		Velocity. Discharge.		Velocity. Discharge.		Velocity. Discharge.		Velocity. Discharge.			
	feet.	gallons	feet.	gallons	feet.	gallons	feet.	gallons	feet.	gallons		
1 in 100	52·8	322	1554	424	5510	537	19,050	600	43,550	600	43,550	90
1 " 132	40	280	1342	370	4800	466	16,520	522	37,900	522	37,900	130
1 " 165	32	252	1205	332	4300	418	14,800	466	33,840	466	33,840	165
1 " 200	26·4	228	1092	300	3890	380	13,470	424	30,800	424	30,800	250
1 " 264	20	198	950	260	3370	330	11,700	368	26,800	368	26,800	380
1 " 330	16	177	848	232	3000	296	10,500	331	24,040	331	24,040	630
1 " 440	12	154	738	202	2620	255	9,040	286	20,175	286	20,175	865
1 " 528	10	140	670	185	2400	233	8,260	261	18,950	261	18,950	1,360
1 " 660	8	126	603	166	2150	209	7,400	233	16,920	233	16,920	1,860
1 " 880	6	109	522	143	1855	181	6,420	202	14,670	202	14,670	2,350
1 " 1056	5	99	475	130	1690	165	5,850	184	13,380	184	13,380	3,500
1 " 1320	4	89	425	116	1500	148	5,250	166	12,020	166	12,020	5,700
1 " 1760	3	77	370	101	1310	127	4,500	143	10,390	143	10,390	..
1 " 2640	2	63	301	83	1075	104	3,700	116	8,466	116	8,466	..

VELOCITY AND DISCHARGE PER MINUTE IN EGG-SHAPED SEWERS, WITH WATER FLOWING AT VARIOUS DEPTHS.
Sewers 6 Feet x 4 Feet.

Inclination.	Depth of Flow in Proportion to Height of Sewer.										Quantity required to give Velocity of 150 Feet per Minute.
	One-eighth. (9 Inches.)		One-quarter. (1 Foot & 6 Inches.)		One-half. (3 Feet.)		Seven-eighths. (Maximum Discharge.)		gallons		
	Velocity.	Discharge.	feet	gallons	feet	gallons	feet	gallons			
										Velocity.		Discharge.	Velocity.	Discharge.
1 in 100	357	2451	462	8628	583	29,700	654	68,410	..	98	
1 " 133	40	313	401	7488	510	25,984	573	59,938	140	140	
1 " 165	33	278	360	6720	456	23,280	513	53,560	175	175	
1 " 200	254	1744	327	6106	414	21,093	466	48,748	270	270	
1 " 264	221	1517	286	5341	360	18,342	405	42,865	410	410	
1 " 330	198	1359	255	4762	322	16,406	363	37,970	640	640	
1 " 440	171	1174	221	4127	279	14,215	314	32,800	875	875	
1 " 528	156	1072	201	3753	255	12,992	286	29,917	1,380	1,380	
1 " 660	139	954	180	3361	228	11,616	256	26,780	2,350	2,350	
1 " 880	6	121	156	2913	197	10,037	243	25,314	3,480	3,480	
1 " 1068	5	110	143	2670	180	9,171	203	21,130	5,600	5,600	
1 " 1320	4	99	127	2372	161	8,203	181	18,938	11,000	11,000	
1 " 1760	3	85	110	2054	140	7,130	156	16,318	..	..
1 " 2640	2	69	90	1681	114	5,800	128	13,389			

TABLE VII.—DISCHARGE OF PIPES (running full).

NOTE.—The velocity in feet per minute may be ascertained in each case by dividing the discharge by the number of gallons contained in each lineal foot of the pipe as given at the top of the column.

Ratio of Head of Water to Length of Pipe.	Diameter of Pipe.							
	$\frac{3}{4}$ Inch. (.005 Galls. per Ft.)	$\frac{1}{2}$ Inch. (.008 Galls. per Ft.)	$\frac{3}{8}$ Inch. (.019 Galls. per Ft.)	1 Inch. (.034 Galls. per Ft.)	$1\frac{1}{4}$ Inch. (.053 Galls. per Ft.)	$1\frac{1}{2}$ Inch. (.076 Galls. per Ft.)	2 Inches. (.135 Galls. per Ft.)	$2\frac{1}{2}$ Inches. (.212 Galls. per Ft.)
1 to 1	2.39	4.91	13.52	27.75	48.55	76.66	157.2	274.8
1 " 2	1.70	3.47	9.56	19.63	34.32	54.23	111.2	194.4
1 " 3	1.38	2.85	7.86	16.13	28.20	44.54	91.3	159.7
1 " 4	1.19	2.46	6.76	13.87	24.27	38.33	78.6	137.4
1 " 5	1.07	2.20	6.05	12.40	21.70	34.28	70.3	122.8
1 " 6	.97	2.00	5.52	11.33	19.81	31.29	64.2	112.2
1 " 7	.90	1.85	5.10	10.47	18.32	28.93	59.3	103.7
1 " 8	.85	1.73	4.78	9.81	17.15	27.09	55.5	97.1
1 " 9	.80	1.64	4.51	9.25	16.18	25.55	52.4	91.6
1 " 10	.75	1.55	4.28	8.78	15.36	24.26	49.7	87.0
1 " 12	.69	1.42	3.91	8.02	14.30	22.16	45.4	79.4
1 " 14	.64	1.32	3.62	7.44	13.00	20.50	42.1	73.5
1 " 16	.60	1.23	3.38	6.94	12.14	19.16	39.3	68.7
1 " 18	.56	1.17	3.19	6.53	11.44	18.10	37.1	64.8
1 " 20	.53	1.10	3.03	6.21	10.85	17.15	35.2	61.3

DISCHARGE OF PIPES (running full).

NOTE.—The velocity in feet per minute may be ascertained in each case by dividing the discharge by the number of gallons contained in each lineal foot of the pipe as given at the top of the column.

Ratio of Head of Water to Length of Pipe.	Diameter of Pipe.							
	$\frac{3}{4}$ Inch. (.005 Galls. per Ft.)	$\frac{1}{2}$ Inch. (.008 Galls. per Ft.)	$\frac{1}{4}$ Inch. (.019 Galls. per Ft.)	1 Inch. (.034 Galls. per Ft.)	$1\frac{1}{2}$ Inch. (.053 Galls. per Ft.)	$1\frac{3}{4}$ Inch. (.076 Galls. per Ft.)	2 Inches. (.135 Galls. per Ft.)	$2\frac{1}{2}$ Inches. (.212 Galls. per Ft.)
1 to 25	.48	.98	2.71	5.55	9.70	15.33	31.4	55.0
1 " 30	.44	.90	2.48	5.08	8.90	14.05	29.3	50.0
1 " 35	.40	.83	2.28	4.69	8.20	12.95	26.5	46.4
1 " 40	.38	.78	2.14	4.40	7.70	12.12	24.9	43.4
1 " 45	.36	.73	2.02	4.14	7.23	11.42	23.4	41.0
1 " 50	.33	.69	1.92	3.93	6.86	10.80	22.2	38.9
1 " 60	.31	.64	1.76	3.60	6.30	9.90	20.4	35.6
1 " 70	.28	.59	1.62	3.32	5.80	9.16	18.8	32.8
1 " 80	.27	.55	1.50	3.10	5.40	8.60	17.5	30.7
1 " 100	.24	.49	1.34	2.77	4.86	7.66	15.7	27.5
1 " 120	.21	.44	1.23	2.52	4.40	6.95	14.3	24.9
1 " 150	.19	.40	1.11	2.27	3.96	6.26	12.8	22.4
1 " 200	.17	.35	.96	1.96	3.43	5.42	11.1	19.4
1 " 250	.15	.31	.85	1.75	3.07	4.85	9.9	17.4
1 " 300	.14	.29	.79	1.61	2.82	4.45	9.1	16.0

DISCHARGE OF PIPES (running full).

NOTE.—The velocity in feet per minute may be ascertained in each case by dividing the discharge by the number of gallons contained in each lineal foot of the pipe as given at the top of the column.

Ratio of Head of Water to Length of Pipe.		Diameter of Pipe.							
		3 Inches. (.305 Galls. per Ft.)	4 Inches. (.54 Galls. per Ft.)	5 Inches. (.85 Galls. per Ft.)	6 Inches. (1.22 Galls. per Ft.)	7 Inches. (1.66 Galls. per Ft.)	8 Inches. (2.17 Galls. per Ft.)	9 Inches. (2.75 Galls. per Ft.)	10 Inches. (3.39 Galls. per Ft.)
1 to 5		galls. per min. 198	galls. per min. 398	galls. per min. 695	galls. per min. 1097	galls. per min. 1613	galls. per min. 2253	galls. per min. 3020	galls. per min. 3933
1 " 10		137	281	491	776	1140	1592	2138	2780
1 " 15		112	230	401	633	931	1300	1745	2270
1 " 20		97	199	347	548	806	1126	1511	1967
1 " 25		86	178	311	491	721	1007	1352	1759
1 " 30		79	162	283	448	658	920	1234	1606
1 " 35		73	150	263	415	610	851	1142	1487
1 " 40		68	141	246	388	570	796	1069	1391
1 " 45		64	133	232	366	538	751	1007	1311
1 " 50		61	126	222	347	510	712	956	1244
1 " 60		56	115	201	317	468	650	873	1136
1 " 70		52	106	186	293	431	594	808	1051
1 " 80		49	99	174	274	408	563	756	983
1 " 90		46	94	164	258	380	536	712	927
1 " 100		43	89	155	245	360	503	676	879

DISCHARGE OF PIPES (running full).

NOTE.—The velocity in feet per minute may be ascertained in each case by dividing the discharge by the number of gallons contained in each lineal foot of the pipe as given at the top of the column.

Ratio of Head of Water to Length of Pipe.	Diameter of Pipe.							
	3 Inches. (.305 Galla. per Ft.)	4 Inches. (.44 Galla. per Ft.)	5 Inches. (.65 Galla. per Ft.)	6 Inches. (1.22 Galla. per Ft.)	7 Inches. (1.66 Galla. per Ft.)	8 Inches. (2.17 Galla. per Ft.)	9 Inches. (2.75 Galla. per Ft.)	10 Inches. (3.39 Galla. per Ft.)
1 " 125	39	80	139	219	323	450	605	786
1 " 150	36	73	127	200	296	411	552	718
1 " 175	33	67	117	183	273	380	510	665
1 " 200	31	62	109	173	262	362	478	622
1 " 250	27	56	98	154	227	317	426	554
1 " 300	25	51	90	142	208	291	390	508
1 " 350	23	47	83	131	193	270	361	470
1 " 400	21	44	78	123	180	252	338	440
1 " 450	20	42	73	116	170	238	319	415
1 " 500	19	40	69	110	161	225	302	393
1 " 600	18	36	63	100	147	206	276	360
1 " 700	17	34	59	93	136	191	256	332
1 " 800	16	31	55	87	127	178	239	320
1 " 900	15	29	52	82	120	168	226	293
1 " 1000	14	28	49	78	114	159	214	278

DISCHARGE OF PIPES (running full).

NOTE.—The velocity in feet per minute may be ascertained in each case by dividing the discharge by the number of gallons contained in each lineal foot of the pipe as given at the top of the column.

Ratio of Head of Water to Length of Pipe.	Diameter of Pipe.									
	12 Inches. (4.91 Galls. per Ft.)	15 Inches. (7.67 Galls. per Ft.)	18 Inches. (11.04 Galls. per Ft.)	21 Inches. (15 Galls. per Ft.)	24 Inches. (19.6 Galls. per Ft.)	27 Inches. (24.8 Galls. per Ft.)	30 Inches. (30.7 Galls. per Ft.)	36 Inches. (44.2 Galls. per Ft.)		
1 to 20	galls. per min. 8,103	galls. per min. 5,420	galls. per min. 8,551	galls. per min. 12,570	galls. per min. 17,552	galls. per min. 23,360	galls. per min. 30,660	galls. per min. 39,665		
1 " 25	2,775	4,848	7,648	11,240	15,698	21,070	27,422	43,265		
1 " 30	2,533	4,426	6,982	10,262	14,330	19,235	25,034	39,490		
1 " 40	2,194	3,833	6,047	8,888	12,411	16,660	21,680	34,200		
1 " 50	1,962	3,428	5,408	7,950	11,100	14,900	19,390	30,588		
1 " 60	1,792	3,130	4,987	7,257	10,133	13,600	17,704	27,926		
1 " 70	1,660	2,897	4,571	6,717	9,382	12,593	16,390	25,854		
1 " 80	1,551	2,710	4,276	6,284	8,776	11,943	15,390	24,182		
1 " 90	1,462	2,555	4,032	5,925	8,274	11,105	14,452	22,000		
1 " 100	1,387	2,424	3,824	5,621	7,850	10,535	13,712	21,623		
1 " 125	1,241	2,168	3,420	5,097	7,021	9,423	12,264	19,346		
1 " 150	1,133	1,980	3,123	4,591	6,411	8,605	11,200	17,665		
1 " 175	1,049	1,832	2,890	4,250	5,933	7,964	10,365	16,350		
1 " 200	981	1,714	2,698	3,974	5,538	7,450	9,695	15,294		
1 " 250	874	1,527	2,410	3,542	4,946	6,633	8,640	13,623		

DISCHARGE OF PIPES (running full).

NOTE.—The velocity in feet per minute may be ascertained in each case by dividing the discharge by the number of gallons contained in each lineal foot of the pipe as given at the top of the column.

Ratio of Head of Water to Length of Pipe.	Diameter of Pipe.							
	12 Inches. (4.91 Gall. per Ft.)	15 Inches. (7.67 Gall. per Ft.)	18 Inches. 11.04 Gall. per Ft.)	21 Inches. (15 Gall. per Ft.)	24 Inches. (19.8 Gall. per Ft.)	27 Inches. (24.8 Gall. per Ft.)	30 Inches. (30.7 Gall. per Ft.)	36 Inches. (44.2 Gall. per Ft.)
1 to 300	galls. per min. 801	galls. per min. 1,400	galls. per min. 2,208	galls. per min. 3,245	galls. per min. 4,582	galls. per min. 6,083	galls. per min. 7,916	galls. per min. 12,488
1 " 350	742	1,296	2,044	3,004	4,196	5,567	7,330	11,560
1 " 400	694	1,212	1,912	2,810	3,925	5,268	6,856	10,814
1 " 450	654	1,143	1,803	2,650	3,700	4,966	6,464	10,198
1 " 500	620	1,084	1,710	2,514	3,510	4,712	6,132	9,675
1 " 600	566	990	1,561	2,295	3,204	4,300	5,597	8,830
1 " 700	524	916	1,415	2,124	2,971	3,982	5,182	8,174
1 " 800	490	857	1,352	1,987	2,775	3,725	4,848	7,647
1 " 900	462	808	1,275	1,873	2,616	3,512	4,570	7,240
1 " 1000	439	766	1,210	1,777	2,482	3,332	4,336	6,840
1 " 1250	392	684	1,081	1,590	2,220	2,980	3,878	6,118
1 " 1500	358	627	987	1,451	2,027	2,720	3,540	5,585
1 " 2000	310	542	855	1,255	1,755	2,356	3,066	4,836
1 " 3000	253	443	698	1,026	1,433	1,924	2,503	3,949
1 " 5000	196	343	541	795	1,110	1,490	1,939	3,059

TABLE VIII.—QUANTITY OF SEWAGE due to POPULATION.

Population.	Average Flow during 24 hours.				Maximum Flow, half in 6 hours.				Allowance for Rainfall for Population of 100 per acre, or 436 super. feet of area per inhabitant.			
	At 20 Galls. per Head.		At 30 Galls. per Head.		At 20 Galls. per Head.		At 30 Galls. per Head.		At 1 Inch in 24 Hours.		At 1 Inch in 24 Hours.	
	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.
500	7	17	10	35	14	21	35	19.6	39.3	79	157	78.7
1,000	14	35	21	69	28	42	69	39	79	157	315	
2,000	28	69	42	104	56	83	104	79	157	315	629	
3,000	42	104	62	139	83	125	139	118	236	472		
4,000	56	139	83		111	167	278	157	315			
5,000	69	174	104		139	208	347	196	393	787		
6,000	83	208	125	243	167	250	417	235	472	944		
7,000	97	243	146	278	194	292	486	275	551	1,101		
8,000	111	278	167	312	222	338	556	314	630	1,258		
9,000	125	312	187		250	375	625	353	708	1,416		
10,000	139	347	208		278	417	694	393	787	1,573		
20,000	278	694	417	625	555	833	1,389	787	1,573	3,146		
30,000	416	625	625	1,041	833	1,250	2,083	1,179	2,358	4,717		
40,000	555	833	833	1,389	1,110	1,667	2,778	1,573	3,146	6,292		
50,000	694	1,042	1,042	1,736	1,389	2,083	3,472	1,966	3,932	7,865		

QUANTITY OF SEWAGE due to POPULATION.

Population.	Average Flow during 24 hours.				Maximum Flow, half in 6 hours.				Allowance for Rainfall for Population of 100 per acre, or 435 super. feet of area per inhabitant.			
	At 20 Galls. per Head.	At 30 Galls. per Head.	At 40 Galls. per Head.	At 50 Galls. per Head.	At 20 Galls. per Head.	At 30 Galls. per Head.	At 40 Galls. per Head.	At 50 Galls. per Head.	At $\frac{1}{2}$ Inch in 24 Hours.	At $\frac{1}{4}$ Inch in 24 Hours.	At $\frac{1}{8}$ Inch in 24 Hours.	At 1 Inch in 24 Hours.
60,000	833	1,250	1,666	2,083	1,666	2,500	3,333	4,166	2,358	4,717	9,434	9,434
70,000	972	1,458	1,944	2,430	1,944	2,916	3,888	4,860	2,812	5,504	11,009	11,009
80,000	1,110	1,667	2,222	2,778	2,222	3,333	4,444	5,556	3,146	6,292	12,584	12,584
90,000	1,250	1,875	2,500	3,125	2,500	3,750	5,000	6,250	3,539	7,079	14,157	14,157
100,000	1,389	2,083	2,778	3,472	2,778	4,166	5,556	6,944	3,932	7,865	15,729	15,729

250 gallons per inhabited house, being about 44 gallons per head, is the quantity prescribed by Act of Parliament to be provided for in the Lower Thames Valley and Darent Valley Main Sewerage Districts. This is understood to include some allowance for rainfall.

Rainfall should not be taken on the basis of population, as in the third column, unless *either* the whole area to be provided for is continuously built upon, or the separate system is adopted and rain not admitted to the sewers except in close proximity to houses.

In the former case, if the population be greater than is assumed, the figures in the Table must obviously be *divided* by the ratio to 100; thus, for population of 200 per acre divide by 2, for 150 per acre take two-thirds, &c., and similarly for 50 per acre multiply by 2, &c.

On the other hand, if the system to be adopted is that of excluding the rain water, the average area pertaining to each inhabited house must first be ascertained and the number of persons per house; and the figures in the third column may be adopted or will require modification, according as the result arrived at compares with the assumption of 435 super feet to each individual.

TABLE IX.—QUANTITY AND DISCHARGE FROM AREAS due to RAINFALL.

Area.	Quantity equal to 1 Inch of Rain over Surface.	Equivalent Supply Daily throughout the Year.	Quantity running off at following Rates.							
			1 Inch in an hour.	½ Inch in an hour.	¼ Inch in an hour.	1 Inch in 24 hours.	½ Inch in 24 hours.	¼ Inch in 24 hours.	1 Inch in 24 hours.	½ Inch in 24 hours.
	gallons	gallons	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.
100 sup. feet	52	0.14	0.87	0.43	0.22	0.036	0.018	0.009	0.005	0.003
200 "	104	0.28	1.74	0.87	0.43	0.072	0.036	0.018	0.009	0.006
300 "	156	0.43	2.60	1.30	0.65	0.108	0.054	0.027	0.013	0.009
400 "	208	0.57	3.47	1.74	0.87	0.144	0.072	0.036	0.018	0.012
500 "	260	0.71	4.34	2.17	1.08	0.181	0.090	0.045	0.022	0.015
1,000 "	520	1.4	8.7	4.3	2.2	0.36	0.18	0.09	0.05	0.03
2,000 "	1,040	2.8	17.4	8.7	4.3	0.72	0.36	0.18	0.09	0.06
3,000 "	1,560	4.3	26.0	13.0	6.5	1.08	0.54	0.27	0.13	0.09
4,000 "	2,080	5.7	34.7	17.4	8.7	1.44	0.72	0.36	0.18	0.12
5,000 "	2,600	7.1	43.4	21.7	10.8	1.81	0.90	0.45	0.22	0.15
10,000 "	5,200	14.2	86.8	43.4	21.7	3.62	1.81	0.90	0.45	0.30
1 acre	22,651	62	377	189	94	15.7	7.9	3.9	2.0	1.3
2 acres	45,302	124	755	377	189	31.5	15.7	7.9	3.9	2.6
3 "	67,954	186	1,132	566	284	47.2	23.6	11.8	5.9	3.9
4 "	90,605	248	1,510	755	378	63.0	31.5	15.7	7.9	5.2
5 "	113,256	310	1,887	944	472	78.7	39.3	19.6	9.8	6.5

QUANTITY AND DISCHARGE FROM AREAS due to RAINFALL.

Area.	Quantity equal to 1 Inch of Rain over Surface.	Equivalent Supply Daily throughout the Year.	Quantity running off at following Rates.							
			1 Inch in an hour.	½ Inch in an hour.	¼ Inch in an hour.	1 Inch in 24 hours.	½ Inch in 24 hours.	¼ Inch in 24 hours.	1 Inch in 24 hours.	½ Inch in 24 hours.
	gallons	gallons	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.	galls. per min.
10 acres	296,512	620	3,775	1,888	944	472	157	79	39	20
20 "	453,025	1,241	7,550	3,775	1,888	944	315	157	79	39
30 "	679,537	1,862	11,326	5,663	2,831	1,415	472	236	118	59
40 "	906,049	2,482	15,101	7,550	3,776	1,888	629	315	157	79
50 "	1,132,561	3,103	18,876	9,438	4,719	2,360	787	393	196	98
100 "	2,265,122	6,206	37,752	18,876	9,438	4,719	1,573	787	393	196
200 "	4,530,245	12,412	75,504	37,752	18,876	9,438	3,146	1,573	787	393
300 "	6,795,367	18,618	113,256	56,628	28,314	14,152	4,717	2,358	1,179	589
400 "	9,060,490	24,823	151,008	75,504	37,752	18,876	6,292	3,145	1,573	787
500 "	11,325,612	31,029	188,760	94,380	47,190	23,595	7,865	3,932	1,966	983
1 square mile	14,496,770	39,717	241,613	120,806	60,403	30,201	10,067	5,033	2,516	1,258

It is estimated that on an average four-fifths of the Rain runs off slated roofs, one-half off streets and paved surfaces; and one-eighth part off the surface of cultivated land, within an hour of falling, whenever the fall is considerable.

TABLE X.—ANNUAL RAINFALL.
Average Rainfall for 30 Years (1870–1899) in British Isles.

Division.	County.	Station.	Height above Sea.	Average Rainfall.
	ENGLAND.		ft.	in.
I.	Middlesex ..	London (Camden Square)	111	25·16
II.	Surrey	Reigate (Nutwood)	440	30·11
	Kent	Selling (Harefield)	217	29·55
	Sussex	Eastbourne (Osborne House) ..	12	30·98
	Hants	Osborne (Newbarn Cottage) ..	172	28·12
	"	Alton (Ashdell)	433	33·20
III.	Herts	Hitchin (Wratten)	238	24·66
	Bucks	High Wycombe	253	24·93
	Oxford	Oxford (Magdalen College) ..	186	24·54
	Northampton ..	Wellingboro (Croyland Abbey) ..	160	25·31
	Cambridge ..	Ely (Stretham)	42	22·16
IV.	Essex	Chelmsford (High Street)	86	22·96
	Suffolk	Ixworth (Walsham-le-Willows) ..	—	25·87
	Norfolk	Geldeston	38	23·93
	"	Hillington School	94	27·17
V.	Wilts	Marlborough (Mildenhall)	456	30·19
	Dorset	Wimborne Minster (Chalbury) ..	338	31·06
	Devon	Ashburton (Druid House)	572	52·91
	"	Barnstaple (Athenæum)	25	38·32
	Cornwall	St. Austell (Trevarna)	300	47·16
	Somerset	E. Harptree (Sherborne Reservoir)	338	41·16
VI.	Hereford	Ross (The Graig)	213	29·51
	"	Kington (Lynhales)	566	33·56
	Salop	Church Stretton (Woolstaston) ..	800	33·04
	"	Adderley Rectory	277	29·13
	Stafford	Burton (Rangemoor)	424	28·01
	Worcester	Northwick Park	410	29·22
VII.	Leicester	Thornton Reservoir	371	26·48
	Lincoln	Horncastle (Revesby)	135	24·77
	Notts	Worksop	56	24·54
VIII.	Cheshire	Woodhead Reservoir	660	48·85
	Lancashire	Ormskirk (Rufford)	39	33·71
	"	Cartmel (Holker)	155	43·69
IX.	York, W. Riding	South Milford Rectory	70	26·08
	" " "	Armeliffe Vicarage	734	60·96
	" E. "	Hull (Pearson Park)	6	27·02
	" N. "	Old Malton	75	26·71
	" " "	Bedale (Thorpe Perrow)	170	27·09

TABLE X.—*continued.*

Division.	County.	Station.	Height above Sea.	Average Rainfall
	ENGLAND— <i>cont.</i>		ft.	in.
X.	Durham	Wolsingham	464	34·75
	Northumberland	Haltwhistle (Unthank Hall) ..	380	35·44
	"	Ilderton (Lilburn Tower) ..	300	29·19
	Cumberland ..	Whitehaven (Irish Street) ..	21	41·29
	" ..	Carlisle (Cemetery)	114	31·64
	Westmorland ..	Kendal (Ivy Garth)	146	50·41
	WALES.			
XI.	Pembroke	Haverfordwest (High Street) ..	95	47·88
	Carnarvon ..	Llanystumdwy (Salarvor) ..	49	35·82
	" ..	Llandudno (Warwick House) ..	90	30·98
	SCOTLAND.			
XII.	Dumfries	Durrisdeer (Drumlanrig Castle)	191	44·28
XIII.	Selkirk	Galashiels (Abbotsford Road) ..	416	33·82
	Berwick	Marchmont House	500	34·91
XIV.	Lanark	Bothwell Castle	146	28·92
	Ayr	Girvan (Pinmore)	187	48·87
	Renfrew	Waulk Glen	280	46·91
XVI.	Kinross	Loch Leven Sluice	360	36·20
	Perth	Loch Drunkie	420	63·09
	Forfar	Craigton	481	37·73
XVII.	Aberdeen	Braemar	1114	36·07
	Elgin or Moray	Gordon Castle	107	30·41
XVIII.	Inverness	Loch Shiel (Glenaladale) ..	50	105·29
XIX.	Sutherland ..	Golspie (Dunrobin Castle) ..	14	81·03
	IRELAND.			
XX.	Waterford	Portlaw (Mayfield)	70	42·38
XXI.	Wexford	Gorey (Courtown House)	80	35·72
	Wicklow	Bray (Fassaroe)	250	40·55
	Carlow	Carlow (Browne's Hill)	291	34·44
XXII.	Galway	Ballinasloe	160	37·04
XXIII.	Cavan	Belturbet (Red Hills)	208	35·19
	Armagh	Armagh Observatory	205	31·36
	Down	Seaforde	180	38·61
	Tyrone	Omagh (Edenfel)	280	37·85

TABLE XI.—MONTHLY AND ANNUAL RAINFALL.

(1) Rainfall at Camden Square, London, during each Month for 42 Years, 1858-1899.

Year.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1858	·88	1·80	·69	2·90	2·76	·92	3·01	1·10	·85	1·58	·53	1·75	18·77
1859	·72	1·23	1·33	2·61	2·13	2·90	2·93	2·65	4·04	2·53	2·90	2·24	28·21
1860	1·97	1·25	1·87	1·45	3·57	5·47	2·26	4·48	2·92	1·77	2·72	2·51	32·24
1861	·43	1·93	2·43	1·80	1·39	2·13	2·42	·94	2·15	1·05	4·65	1·45	22·27
1862	1·92	·31	3·69	2·30	3·06	2·43	2·61	2·74	2·19	3·50	1·13	1·71	27·59
1863	2·80	·67	·85	·52	1·27	4·86	·92	1·44	3·49	1·62	1·84	1·31	21·59
1864	1·02	·85	2·62	·82	1·86	1·28	·62	1·33	2·55	1·13	2·49	·36	16·93
1865	3·90	2·01	1·12	·33	3·40	2·21	2·33	4·10	·55	6·22	1·96	1·35	29·48
1866	3·90	3·72	1·69	1·76	2·03	3·98	1·19	2·76	3·89	2·32	1·73	2·63	31·60
1867	2·81	1·44	2·48	2·36	2·45	1·22	4·30	2·63	2·23	1·92	·86	1·59	26·29
1868	3·89	1·21	1·28	1·50	1·58	·78	·45	2·28	1·74	2·54	1·03	5·12	23·40
1869	2·76	2·48	1·97	1·28	3·27	1·03	·62	1·26	3·56	1·87	2·38	2·94	25·42
1870	1·38	1·21	2·31	·47	·70	·83	1·22	2·69	2·00	3·68	1·76	3·07	21·32
1871	1·99	1·27	1·19	2·84	·92	3·49	4·12	·85	5·28	1·34	·60	1·13	25·02
1872	3·46	·96	2·66	1·39	3·05	2·55	2·57	2·05	1·64	5·20	3·98	4·35	33·86
1873	2·44	1·96	1·46	·55	1·56	2·24	2·81	2·87	2·46	2·97	1·87	·48	22·67
1874	1·18	·91	·39	1·26	1·14	2·05	·82	1·32	2·62	3·34	2·21	1·58	18·82
1875	3·22	1·06	·69	1·53	1·61	2·40	4·63	1·79	2·86	4·35	3·36	·94	28·44
1876	·94	1·97	2·96	1·90	·94	1·27	·81	1·79	2·86	1·40	3·07	6·25	26·16
1877	4·74	1·78	2·38	2·59	1·91	·42	3·94	2·23	·82	1·97	3·88	1·51	28·17
1878	1·31	1·49	1·12	4·97	3·89	6·71	·64	6·72	·83	1·99	2·95	1·46	34·08
1879	2·87	3·77	·91	2·72	3·46	4·76	4·17	5·11	3·67	·80	·72	·86	33·82
1880	·31	2·33	·79	2·15	·26	4·04	5·11	·45	4·04	5·78	1·85	3·17	30·28
1881	1·85	3·09	2·30	·46	1·52	1·72	1·85	4·89	2·03	2·99	2·75	2·47	27·92
1882	1·30	1·30	1·35	2·83	1·20	2·30	2·95	1·48	2·39	4·96	2·57	2·51	27·14
1883	2·08	3·62	·86	1·56	1·97	1·35	2·92	·93	3·83	1·75	2·78	·75	24·40
1884	2·30	1·40	1·41	1·02	·78	2·84	2·46	·89	1·77	·99	1·92	2·57	20·35
1885	1·43	2·86	1·65	2·32	2·63	1·99	·52	·85	4·30	3·73	3·31	1·05	26·64

TABLE XI.—continued.

Year.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1886	4·02	·63	1·38	1·22	4·79	·63	2·37	·76	1·73	2·43	2·71	4·34	27·01
1887	1·26	·48	1·65	1·41	1·45	·91	1·07	3·15	1·81	1·24	3·40	1·38	19·21
1888	·90	·78	3·34	2·37	1·18	2·31	4·91	3·61	1·43	1·23	4·38	1·29	27·73
1889	·81	2·28	1·36	2·06	3·22	2·03	2·64	1·80	1·77	3·75	·89	1·23	23·84
1890	2·46	1·04	1·76	2·02	1·25	2·82	4·19	1·55	·64	1·20	1·62	·68	21·23
1891	1·80	·01	2·01	1·13	2·72	·86	3·82	4·75	1·03	4·80	1·98	3·24	28·15
1892	·50	1·62	1·04	·99	1·51	2·46	1·62	3·06	2·12	3·78	2·53	1·37	22·60
1893	1·44	2·87	·32	·24	·80	·73	2·46	1·61	1·07	3·87	2·16	2·23	19·80
1894	2·87	1·74	1·18	1·74	1·85	1·84	3·25	2·85	1·04	4·45	2·85	2·28	27·94
1895	1·96	·12	1·42	1·34	·34	·30	3·42	3·09	1·28	2·84	3·17	2·19	21·47
1896	·78	·29	3·20	·55	·14	2·27	1·03	1·92	5·51	3·05	1·17	3·61	23·52
1897	2·05	2·75	3·42	1·57	1·08	1·87	·64	2·92	2·75	·56	1·05	2·20	22·86
1898	·73	1·98	1·46	1·01	2·26	1·11	1·09	1·18	·33	2·96	1·94	2·54	17·69*
1899	2·52	2·00	·50	2·64	1·38	1·49	1·45	·70	2·65	2·03	4·13	1·05	22·54
Mean	2·00	1·58	1·68	1·67	1·91	2·19	2·33	2·31	2·35	2·70	2·33	2·12	25·20

Greatest fall in one civil year (1878), 34·08.

" " twelve months (March 1878 to February 1879), 37·92

" " six months (March to August 1878) 24·65.

" " three months (March, April, May 1878), 15·57.

" " two months (December 1876, January 1877), 10·99

" " one month (August 1878), 6·72.

Least fall in one civil year (1864), 18·93.

" " twelve months (October 1897 to September 1898), 14·06.

" " six months (December 1873 to June 1874), 5·36.

" " four months (December 1873 to March 1874), 2·96.

" " three months (February, March, April, 1863), 1·94.

" " two months (March, April, 1893), ·56.

" " one month (February 1891), ·01.

Least average of three consecutive years (1897-8-9), 21·03.

* This was the total fall registered at Camden Square, but much lower records were obtained at other stations at lower elevation, viz. at Shorditch, 14·30; East Ham, 14·08; Barking Outfall, 13·04; thus making 1898 the driest year for half a century over a considerable area.

TABLE XI.—continued.

(2) Average Monthly Rainfall at various stations in British Isles during 30 Years, 1870-1899.

Station.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
ENGLAND.													
Camden Square . . .	1.9	1.6	1.6	1.7	1.7	2.1	2.5	2.4	2.3	2.8	2.4	2.1	25.0
Eastbourne . . .	2.7	2.1	2.0	1.9	1.6	1.8	2.4	2.4	3.1	4.1	3.7	3.2	31.0
Hitchin . . .	1.8	1.5	1.5	1.6	1.9	1.9	2.5	2.3	2.3	2.7	2.6	2.0	24.7
High Wycombe . . .	2.2	1.8	1.6	1.6	1.6	1.8	2.1	2.1	2.4	2.9	2.6	2.3	24.9
Ely . . .	1.3	1.1	1.1	1.4	1.8	2.0	2.8	2.4	2.2	2.4	2.1	1.5	22.2
Marlborough . . .	2.6	2.2	1.9	2.0	1.9	2.2	2.8	2.7	2.6	3.3	3.3	2.7	30.2
Barnstaple . . .	3.4	2.8	2.3	2.2	2.1	2.3	3.3	3.4	3.6	4.9	4.0	4.1	38.5
Ross (Hereford) . . .	2.7	2.2	1.7	1.9	2.1	2.3	2.8	2.6	2.7	3.1	2.9	2.4	29.4
Ormakirk . . .	2.7	2.0	2.2	1.7	2.1	2.4	3.4	3.6	3.4	3.9	3.2	3.1	33.7
Cartmel (Lancs.) . . .	3.9	2.9	3.1	2.2	2.4	2.8	3.9	4.4	4.4	5.0	4.3	4.2	43.7
Old Malton (Yorks) . . .	1.9	1.7	1.8	1.7	1.9	2.1	2.6	2.7	2.3	3.1	2.5	2.4	26.7
Kendal . . .	5.2	3.7	3.8	2.4	2.9	3.0	4.3	4.9	4.6	5.3	4.9	5.3	50.4
WALES.													
Haverfordwest . . .	5.1	3.7	3.0	2.6	2.5	2.6	3.7	4.0	4.2	5.6	5.4	5.2	48.0
Llandudno . . .	2.6	2.0	2.0	1.8	1.8	2.0	2.6	2.9	2.9	4.1	3.4	2.9	31.1
SCOTLAND.													
Bothwell Castle (Lanark) . . .	2.6	1.9	1.9	1.4	1.9	2.2	2.9	3.2	2.7	2.6	2.8	2.8	28.9
Waulk Glen (Renfrew) . . .	5.2	3.7	3.5	2.3	2.7	2.9	3.4	4.3	4.3	4.6	5.0	5.2	46.9
Loch Leven . . .	3.3	2.8	2.6	2.0	2.3	2.4	3.1	3.7	2.9	3.6	3.7	3.7	36.2
Craigton . . .	3.0	2.9	2.6	2.6	2.5	2.7	3.6	4.1	3.2	3.5	3.5	3.5	37.7
Braemar . . .	2.9	2.7	2.4	2.2	2.4	2.4	2.9	3.8	3.2	4.1	3.9	3.1	36.0
IRELAND.													
Portlawn (Waterford) . . .	4.5	3.7	2.7	2.9	2.5	2.6	3.2	3.9	3.2	4.3	4.1	4.7	42.2
Bray . . .	3.8	3.6	2.9	2.8	2.6	2.5	2.9	3.3	3.0	4.7	4.4	3.9	40.5
Ballinasloe . . .	3.5	2.5	2.4	2.4	2.5	2.7	3.4	3.9	3.2	3.6	3.6	3.6	37.0
Armagh . . .	2.6	2.1	2.0	2.0	2.1	2.5	3.2	3.3	2.9	3.0	2.8	2.8	31.3
Omagh (Tyrone) . . .	3.4	2.5	2.5	2.2	2.4	2.9	3.3	4.0	3.6	3.7	3.5	3.8	37.8
Average of 24 Stations . . .	3.1	2.5	2.3	2.1	2.2	2.4	3.1	3.3	3.1	3.7	3.5	3.4	34.8

TABLE XII.—DAILY and HOURLY MAXIMUM RAINFALL.

Period.	Greatest Ordinary Heavy Fall (as defined in "British Rainfall," all beyond this being recorded as "Exceptional").	Exceptional Falls recorded during the Years 1870 to 1899.
hours		Fall during the Year.
		8·03 at Seathwaite, Cumberland, in 1897 . 143·4
	2½ inches, where the total fall during the year exceeds 33 inches.	7·74 at Ben Nevis Observatory in 1894 151·7
		6·70 at Angerton, near Morpeth, in 1898 36·9 (During an extraordinary storm which lasted only about 3 hours.)
		6·00 at Tongue, Sutherland, in 1870 .. 35·1
		5·00 at Blaenau Festiniog, in 1898 . 126·9
24		4·78 at Sittingbourne, being 17·7 p. c. of 27·0.
	7·5 per cent. of the fall during the year, where it does not exceed 33 inches.	4·48 at Fakenham, being 16·2 p. c. of 27·6.
		4·45 at N. Ockendon, Essex, being 16·5 p. c. of 27·0.
		4·83 at Churchstoke, Montgomery, being 16·1 p. c. of 30.
		4·93 at Galway, being 13 p. c. of 37·9.
2	{ .1 inch, or at rate of .50 in. per hr. }	{ 3·75 inches. Flax Bourton, Somerset, July 16, 1892.
		{ 3 inches. Rotherham, September 15, 1880.
1½	{ .85 inch, or at rate of .56 in. per hr. }	{ 3·07 inches = 2·05 in. per hour. Athlone, June 25, 1880.
1	.75 inch . . .	2·58 inches. Sale, July 25, 1886.
min.		
45	{ .65 inch, or at rate of .87 in. per hr. }	
30	{ .50 inch, or at rate of 1 in. per hr. }	{ 2·90 inches = 5·80 in. per hour. Cowbridge, South Wales, July 22, 1880.
20	{ .40 inch, or at rate of 1·20 in. per hr. }	{ 1·48 inches = 4·44 in. per hour. Barnstaple, June 30, 1879.
15	{ .35 inch, or at rate of 1·40 in. per hr. }	{ 0·75 inch = 3 in. per hour. Oxford, August 6, 1898.
10	{ .30 inch, or at rate of 1·80 in. per hr. }	{ 1 inch = 6 in. per hour. London, June 23, 1878.
5	{ .20 inch, or at rate of 2·40 in. per hr. }	{ .40 inch in 3 minutes = 8 in. per hour. London, June 23, 1878.

TABLE XIII.—WATER SUPPLY by GRAVITATION—

NOTE.—Dimensions of Service Reservoirs and Distributing

Population.	Supply Required at 20 Gallons per Head.		Area of Gathering Ground for 12 Inches Available Rainfall.	Storage Reservoir to Hold Supply for 150 Days.
	Daily.	Equivalent per Minute.		
	gallons	gallons	acres	
500	10,000	7	13½	175 ft. diam. by 10 ft. deep
1,000	20,000	14	27	226 " 12 "
2,000	40,000	28	53½	320 " 12 "
3,000	60,000	42	80½	{ 391 " 12 " } 2½ acres by 12 "
5,000	100,000	70	134	3½ " 15 "
6,000	120,000	84	161	4½ " 15 "
8,000	160,000	112	215	6 " 15 "
10,000	200,000	139	268	{ 7½ " 15 " } 5½ " 20 "
20,000	400,000	278	536	{ 15 " 15 " } 11 " 20 "
30,000	600,000	417	805	16½ " 20 "
50,000	1,000,000	694	1340	27½ " 20 "
60,000	1,200,000	833	1610	33 " 20 "
80,000	1,600,000	1,111	2145	44 " 20 "
100,000	2,000,000	1,389	sq. miles 4.2	{ 55 " 20 " } 4½ " 25 "
500,000	10,000,000	6,944	21	{ 220 " 25 " } 183 " 30 "
1,000,000	20,000,000	13,889	42	{ 440 " 25 " } 367 " 30 "

WORKS for GIVEN POPULATION.

Mains same as for Pumping Works. (See next page.)

Filter Beds to Pass 600 Gallons per Super. Yard in 24 Hours, allowing for one not in use.	Main Conduit to Pass Supply in 24 Hours, flowing continuously.
No. 2, each 15 ft. by 10 ft.	{ 1½ inch, loss of head 1 in 120 2 " " " 1 " 400
" " 20 " 15 "	{ 2 " " " 1 " 120 3 " " " 1 " 1000
No. 3, " 30 " 10 "	{ 3 " " " 1 " 240 4 " " " 1 " 1000
" " 30 " 15 "	{ 4 " " " 1 " 450 5 " " " 1 " 1200
" " 50 " 15 "	{ 4 " " " 1 " 160 6 " " " 1 " 1200
" " 50 " 18 "	{ 5 " " " 1 " 350 6 " " " 1 " 900
" " 60 " 20 "	{ 6 " " " 1 " 500 7 " " " 1 " 1000
No. 4, " 50 " 20 " or 32 ft. sq.	{ 6 " " " 1 " 300 8 " " " 1 " 1250
No. 4, each 45 ft. square ..	{ 9 " " " 1 " 600 10 " " " 1 " 1000
" " 55 " ..	{ 10 " " " 1 " 450 12 " " " 1 " 1000
" " 70 " ..	{ 12 " " " 1 " 400 15 " " " 1 " 1200
" " 76 " ..	{ 12 " " " 1 " 275 15 " " " 1 " 850
" " 90 " ..	{ 15 " " " 1 " 480 18 " " " 1 " 1200
No. 6 " 77½ " ..	{ 18 " " " 1 " 750 21 " " " 1 " 1700
" " 173 " ..	{ 2½ feet, " " 1 " 400 3 " " " 1 " 1000
" " 245 " ..	{ 3 " " " 1 " 250 4 " " " 1 " 1000

TABLE XIV.—WATER SUPPLY by PUMPING—

Population.	Supply Required at 20 Gallons per Head.		Hours during which it is proposed to Pump.	Net Horse-power to raise to 100 Feet Elevation.
	Daily.	Equivalent per Minute.		
500	gallons 10,000	gallons 7	4	1½
1,000	20,000	14	6	1¾
2,000	40,000	28	10	2
3,000	60,000	42	10	3
5,000	100,000	70	10	5
6,000	120,000	84	10	6
8,000	160,000	112	10	8
10,000	200,000	139	10	10½
20,000	400,000	278	18	11½
30,000	600,000	417	24	12¾
50,000	1,000,000	694	24	21
60,000	1,200,000	833	24	25½
80,000	1,600,000	1,111	24	33½
100,000	2,000,000	1,389	24	42
500,000	10,000,000	6,944	24	210
1,000,000	20,000,000	13,889	24	421

WORKS for GIVEN POPULATION.

Dimensions of Single Pump, working 10 Strokes per Minute.		Dimensions of Pumping Main.		Service Reservoir to hold Three Days' Supply.	Main Delivery Pipe to Pass at Rate of One-half in Four Hours.	
Diam.	Stroke.	Diam.	Loss of Head.		Diam.	Loss of Head.
in.	ft. in.	in.			in.	
8	2 0	3	1 in 110	22 ft. sq. by 10 ft. deep	3	1 in 400
9	2 0	4	1 „ 450	31 „ 10 „	4	1 „ 450
10	2 0	5	1 „ 500	40 „ 12 „	5	1 „ 350
12	2 1	5	1 „ 240	49 „ 12 „	6	1 „ 380
14	2 6	6	1 „ 220	56½ „ 15 „	8	1 „ 580
15	2 8	7	1 „ 330	62 „ 15 „	8	1 „ 400
16	3 0	8	1 „ 350	71½ „ 15 „	9	1 „ 400
18	3 1	9	1 „ 400	80 „ 15 „	10	1 „ 450
18	3 4½	9	1 „ 335	98 „ 20 „	15	1 „ 850
18	3 9	10	1 „ 450	120 „ 20 „	15	1 „ 440
21	5 0	12	1 „ 400	155 „ 20 „	18	1 „ 310
24	4 3	15	1 „ 850	170 „ 20 „	21	1 „ 500
24	5 8	15	1 „ 475	196 „ 20 „	24	1 „ 570
24	7 0	18	1 „ 770	220 „ 20 „	27	1 „ 650
3·9	10 0	ft. in. 2 6	1 „ 385	438 „ 25 „	ft. in. 4 0	1 „ 500
5·0	11 4	3 0	1 „ 245	620 „ 25 „	6 0	1 „ 880

TABLE XV.—ANALYSIS OF WATER.

The Results are given in parts per 100,000. To convert into grains per gallon (the measure adopted by many analysts for some of the constituents) multiply by seven-tenths. Grains per gallon of Hardness are generally described as "degrees of hardness."

Source or Description.	Total Solids in Solution.	Hardness.		Nitrogen as Nitrate.	Chlorides.	Oxygen absorbed in 4 hours.	Ammonia.		Remarks.
		Total.	Per cent.				Free.	Albuminoid.	
<i>Waters supplied by London Companies.</i>									
New River (River Lea and Walls) ..	29.3	19.2	6.2	.230	1.84	.059	.0009	.0049	These figures represent the average of analyses taken weekly throughout the year 1892.
East London (River Lea) ..	29.0	19.1	6.2	.209	1.99	.091	.0013	.008	
West Middlesex (Thames) ..	29.9	18.7	6.2	.214	1.79	.109	.0009	.007	
Southwark and Vauxhall (Thames) ..	28.8	18.8	6.3	.251	1.80	.099	.0009	.0086	
Grand Junction (Thames) ..	29.9	18.6	6.6	.218	1.81	.102	.0010	.0074	
Lambeth (Thames) ..	28.8	18.8	6.3	.250	1.86	.106	.0006	.007	During floods on the River Thames at same period, the oxygen absorbed by waters of the Thames companies increased to .160, and the albuminoid ammonia to .014.
Chelsea (Thames) ..	29.1	18.5	6.5	.218	1.81	.089	.0012	.0065	
<i>Water supplied from deep wells.</i>									
Chalk—Kent (London Company) ..	33.2	22.2	7.8	.334	2.39	.023	.0008	.0018	The borings are taken into the chalk, but the water is derived principally from the Reading Beds overlying same.
Canterbury ..	34.0	26.6	3.7	.54	1.86	.018	.001	.001	
Sudbury, Suffolk ..	53.0	28.4	2.4	.43	4.8	.007	0	.002	
Chalk, etc. (see Remarks)—Southend ..	96.0	2.8	..	.028	30.49	.087	0	.0036	The borings are taken into the chalk, but the water is derived principally from the Reading Beds overlying same.
Artesian Well at Blackfriars ..	74.8	7.0	..	.02	13.67	.015	.015	.004	
Artesian Well at Newington ..	123.2	..	..	0	16.0	.035	.033	.004
New Red Sandstone—Wolverhampton ..	27.0	16.7	9.2	.071	2.14	.004	0	0	
Coventry (Whitley) ..	37.0	35.0	9.2	.67	2.00	..	.004	0	
Liverpool (Green Lane Well) ..	32.8	26.8	..	.482	3.25	.002	.001	.007	The borings are taken into the chalk, but the water is derived principally from the Reading Beds overlying same.
Kentish Rag Stone, near Maidstone ..	46.9	24.8	9.3	.665	3.28	.025	.0005	.0015	

Oolites—Spalding Peterborough	68.4 40.5	10.0 28.2	.. 6.7	0 1.95	14.85 ..	.074 0	.004 .002	{ Average of many brewery wells. (The solids contain sulphates of lime and magnesia.)
Keuper or Marl Beds, Burton-on-Trent ..	220.0	..	..	.08	6.5	.003	.004	
Carboniferous Limestone, Ingleton, Yorks	13.5	10.0	4.0	..	..	.005	.005	{ Well in gravel beds. Well 15 feet deep, in river gravel.
<i>Waters from shallow wells.</i>								
Burnham, Essex (public supply)	49.3	21.4	11.4	1.20	5.0	.050	.005	{ Average of a great many wells, various depths, in gravel overlying Keuper beds.
St. Neots, Hunts (public supply)	51.4	31.4	14.3	.98	3.4	.033	.007	
Burton-on-Trent (private wells)	111.0	..	..	1.6	8.5	.006	.008	{ Average of 40 wells in gravel, liable to pollution.
Southminster, Essex (private wells) ..	123.0	33.0	..	2.4	1.6	.25	.020	
<i>Waters supplied from upland surfaces.</i>								{ Moorland, Lower Silurian rocks. Moorland, Millstone Grit. Moorland.
Glasgow, Loch Katrine	2.76	1.4	..	.006	.57	0	.003	
Manchester, Longdendale	17.0	10.0	10.0	.07	1.4	.005	.003	{ Moorland, Silurian rocks. (Cultivated land, subsoil, North- ampton sand. Principally moorland, subsoil granite.
Liverpool, Rivington Pike	9.2	5.6	..	0	1.5	.045	.003	
Liverpool, Lake Vyrnwy	4.16	2.4	..	0	.9	.132	.002	{ Average of analyses taken weekly throughout year 1892. Average daily, every 2 hours, throughout year 1894.
Kettering	20.4	15.0	7.0	.043	1.51	.100	0	
Plymouth	2.8	2.1	2.1	.014	1.14	.124	.0007	{ Average of analyses taken weekly throughout year 1892. Average daily, every 2 hours, throughout year 1894.
<i>Other waters, &c.</i>								
River Thames at Hampton	34.0	19.0	6.5	.199	1.75	.186	.007	{ The analyses of sewage are ex- clusive of suspended matters.
London Sewage—Northern outfall	86.0	..	..	..	15.7	4.46	4.32	
Southern outfall	129.7	..	..	..	35.4	5.27	4.23	{ The analyses of sewage are ex- clusive of suspended matters.
Croydon Sewage—Effluent from Farm ..	46.0	..	..	.88	3.25	1.13	4.55	
Sutton Sewage—Crude	157.9	..	..	0	11.47	2.94	3.00	{ The analyses of sewage are ex- clusive of suspended matters.
Effluent from Bacteria Beds	97.8	..	..	3.43	8.53	0.83	0.34	
Sea Water	3800	800	750	.03	2000	..	.005	.027

TABLE XVI.—QUANTITY of BRICKWORK in CIRCULAR SEWERS, CULVERTS, or WELLS.

NOTE.—The quantity of earth displaced will be the sum of the contents and brickwork added together.

Internal Diameter.	Contents of One Lineal Yard.	Brickwork per Lineal Yard.		Internal Diameter.	Contents of One Lineal Yard.	Brickwork per Lineal Yard.	
		4½ Inches Thick.	9 Inches Thick.			9 Inches Thick.	14 Inches Thick.
ft. in.	cub. ft.	cub. ft.	cub. ft.	ft. in.	cub. ft.	cub. ft.	cub. ft.
1 6	5.3	6.6	15.9	6 0	84.8	47.7	75.6
1 9	7.2	7.5	17.7	6 6	99.5	51.2	80.8
2 0	9.4	8.4	19.4	7 0	115.5	54.8	86.1
2 3	11.9	9.3	21.2	7 6	132.5	58.3	91.3
2 6	14.7	10.1	23.0	8 0	150.8	61.8	96.8
2 9	17.8	11.0	24.7	8 6	170.2	65.4	102.1
3 0	21.2	11.9	26.5	9 0	190.9	68.9	107.4
3 3	24.9	12.7	28.3	9 6	212.6	72.4	112.7
3 6	28.9	13.7	30.0	10 0	235.6	76.0	118.0
3 9	33.1	14.6	31.8	11 0	285.1	83.1	128.5
4 0	37.6	15.5	33.6	12 0	339.3	90.0	139.1
4 6	47.7	17.2	37.1	13 0	398.2	97.2	149.8
5 0	58.9	19.0	40.6	14 0	461.8	104.2	160.35
5 6	71.3	20.7	44.2	15 0	530.1	111.3	171.0

TABLE XVII.—QUANTITY of BRICKWORK in EGG-SHAPED SEWERS.

Internal Dimensions.		Contents of One Lineal Yard.	Brickwork per Lineal Yard.		Internal Dimensions.		Contents of One Lineal Yard.	Brickwork per Lineal Yard.					
			4½ In. Thick.	9 In. Thick.				4½ In. Thick.	9 In. Thick.				
ft.	in.	ft.	in.	cub. ft.	cub. ft.	ft.	in.	ft.	in.	cub. ft.	cub. ft.		
2	0	1	4	6.0	7.4	16.5	3	6	2	4	18.5	11.6	25.5
2	3	1	6	8.2	8.1	18.8	3	9	2	6	21.2	12.4	26.9
2	6	1	8	9.4	8.8	20.1	4	0	2	8	24.2	13.0	28.3
2	9	1	10	11.4	9.5	21.4	4	6	3	0	32.9	14.4	31.1
3	0	2	0	13.6	10.2	22.7	5	0	3	4	37.7	15.8	34.0
3	3	2	2	15.9	10.9	24.0	6	0	4	0	54.2	18.8	39.4

In egg-shaped sewers about one-seventh part of the brickwork forms the invert, three-sevenths the top, and three-sevenths the sides. The two former should generally be built with radiating bricks of the radius required in each case.

TABLE XVIII.—WEIGHT OF CAST-IRON PIPES.

NOTE.—The weight includes proportion due to sockets, pipes of 2 and 2½ inches diameter being in 6-foot lengths, pipes 3 to 12 inches inclusive in 9-foot lengths, and those of larger size in 12-foot lengths, exclusive of socket.

Internal Diam-ter of Pipe.	For Pressure not exceeding 150 Feet.			For Pressure not exceeding 300 Feet.			For Pressure not exceeding 500 Feet.					
	Thick- ness of Metal.	Weight per Yard.		Thick- ness of Metal.	Weight per Yard.		Thick- ness of Metal.	Weight per Yard.				
Inches	inch	cwt.	qrs.	lbs.	inch	cwt.	qrs.	lbs.	inch	cwt.	qrs.	lbs.
2	$\frac{3}{8}$	0	0	2½	$\frac{1}{8}$	0	0	26	$\frac{1}{16}$	0	1	0
2½	$\frac{1}{2}$	0	1	0	$\frac{1}{8}$	0	1	2	$\frac{3}{8}$	0	1	6
3	$\frac{1}{2}$	0	1	5	$\frac{1}{8}$	0	1	9	$\frac{3}{8}$	0	1	14
4	$\frac{1}{2}$	0	1	22	$\frac{3}{8}$	0	1	26	$\frac{7}{8}$	0	2	5
5	$\frac{3}{8}$	0	2	14	$\frac{7}{8}$	0	2	21	$\frac{1}{2}$	0	3	4
6	$\frac{3}{8}$	0	2	21	$\frac{7}{8}$	0	3	5	$\frac{1}{2}$	0	3	21
7	$\frac{7}{8}$	0	3	24	$\frac{1}{2}$	1	0	12	$\frac{9}{16}$	1	1	0
8	$\frac{7}{8}$	1	0	12	$\frac{1}{2}$	1	1	0	$\frac{9}{16}$	1	1	21
9	$\frac{1}{2}$	1	1	12	$\frac{9}{16}$	1	2	2	$\frac{5}{8}$	1	2	21
10	$\frac{1}{2}$	1	2	0	$\frac{9}{16}$	1	2	21	$\frac{5}{8}$	1	3	14
12	$\frac{9}{16}$	2	0	0	$\frac{5}{8}$	2	0	25	$\frac{1}{2}$	2	1	21
14	$\frac{5}{8}$	2	2	18	$\frac{1}{2}$	2	3	21	$\frac{3}{4}$	3	0	21
15	$\frac{5}{8}$	2	3	7	$\frac{1}{2}$	3	0	10	$\frac{1}{2}$	3	2	14
16	$\frac{5}{8}$	3	0	0	$\frac{3}{4}$	3	2	9	$\frac{3}{4}$	4	0	21
18	$\frac{1}{2}$	3	2	0	$\frac{3}{4}$	4	0	0	$\frac{1}{2}$	4	3	21
21	$\frac{1}{2}$	4	1	0	$\frac{1}{2}$	5	0	0	1	6	1	14
24	$\frac{3}{4}$	5	1	0	$\frac{3}{4}$	6	1	0	$\frac{1}{2}$	8	0	0
27	$\frac{3}{4}$	6	0	0	$\frac{1}{2}$	7	2	0	$\frac{1}{2}$	9	1	0
30	$\frac{3}{4}$	7	3	14	1	8	3	21	$\frac{1}{2}$	11	1	0
36	1	10	2	21	$\frac{1}{2}$	11	2	14	$\frac{1}{2}$	15	3	14

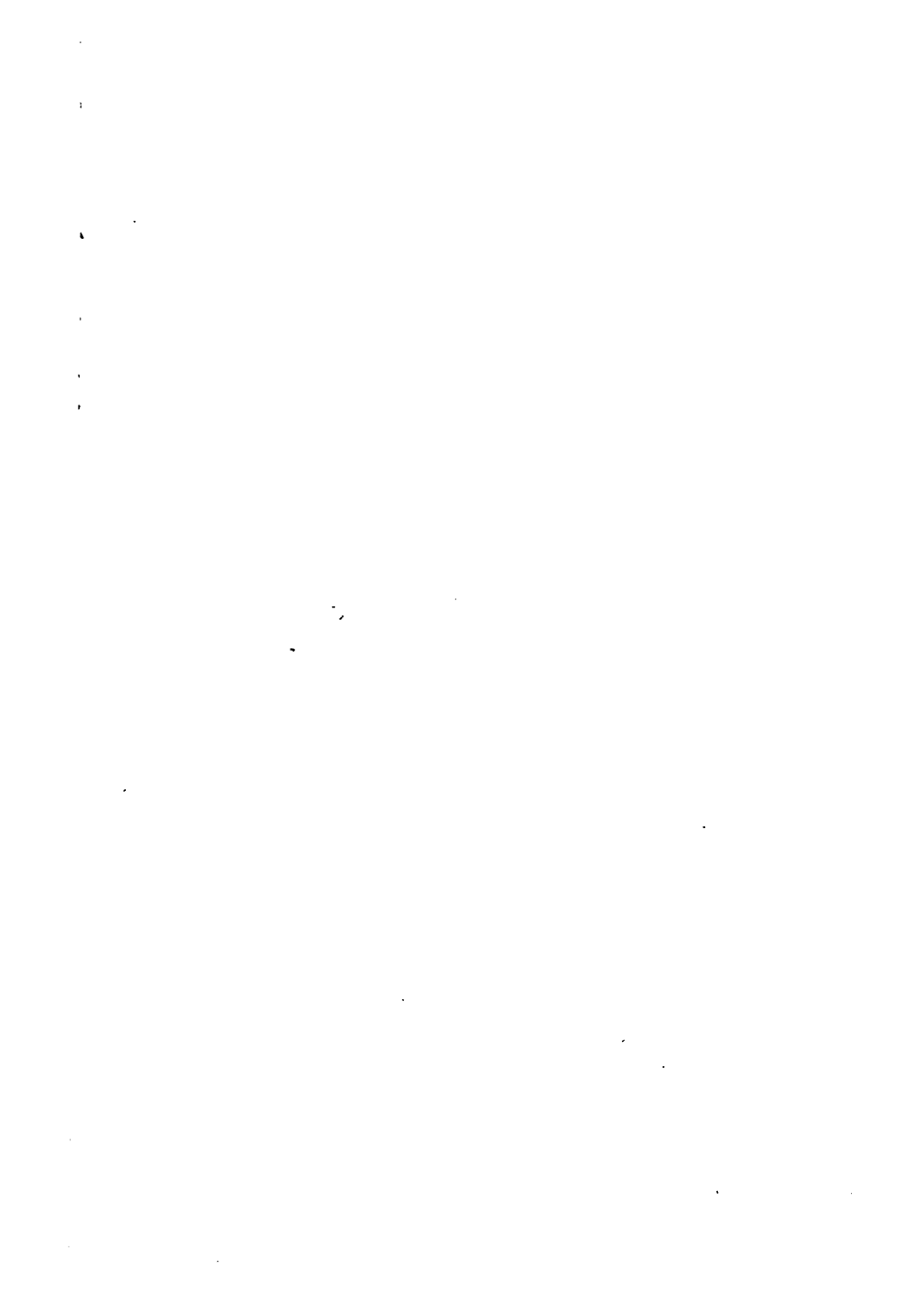
TABLE XIX.—WEIGHT OF LEAD PIPES.

NOTE.—Columns 1, 2, and 3 are the pipes usually known as “common,” “midding,” and “strong” respectively, the figures in parenthesis show the weights per length of the coil according to which they are generally specified. The “common” are available only for pipes with open ends, the “midding” for very slight pressures, and the “strong” for pressure of about 50 feet.

Column 4 are the weights prescribed by the Metropolis Water Act, 1871, and by the regulations of very many towns, and are available for pressures up to 200 feet or thereabouts.

Column 5 are those prescribed at Norwich and some other towns where the pressure is unusually great.

Internal Diameter of Pipe.	Weight per Yard in Lbs.				
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
$\frac{3}{8}$ inch	..	..	..	5	5½
$\frac{1}{2}$ "	3½ (16 lbs. to 15 ft.)	4½ (22 lbs. to 15 ft.)	5½ (26 lbs. to 15 ft.)	6	7
$\frac{5}{8}$ "	..	..	..	7½	9
$\frac{3}{4}$ "	4½ (24 lbs. to 15 ft.)	5½ (28 lbs. to 15 ft.)	7½ (36 lbs. to 15 ft.)	9	11
1 "	6 (30 lbs. to 15 ft.)	8 (40 lbs. to 15 ft.)	9½ (46 lbs. to 15 ft.)	12	16
1½ "	9 (36 lbs. to 12 ft.)	11 (44 lbs. to 12 ft.)	13 (53 lbs. to 12 ft.)	16	22½
1¾ "	12 (48 lbs. to 12 ft.)	14 (56 lbs. to 12 ft.)	17½ (70 lbs. to 12 ft.)	24	33



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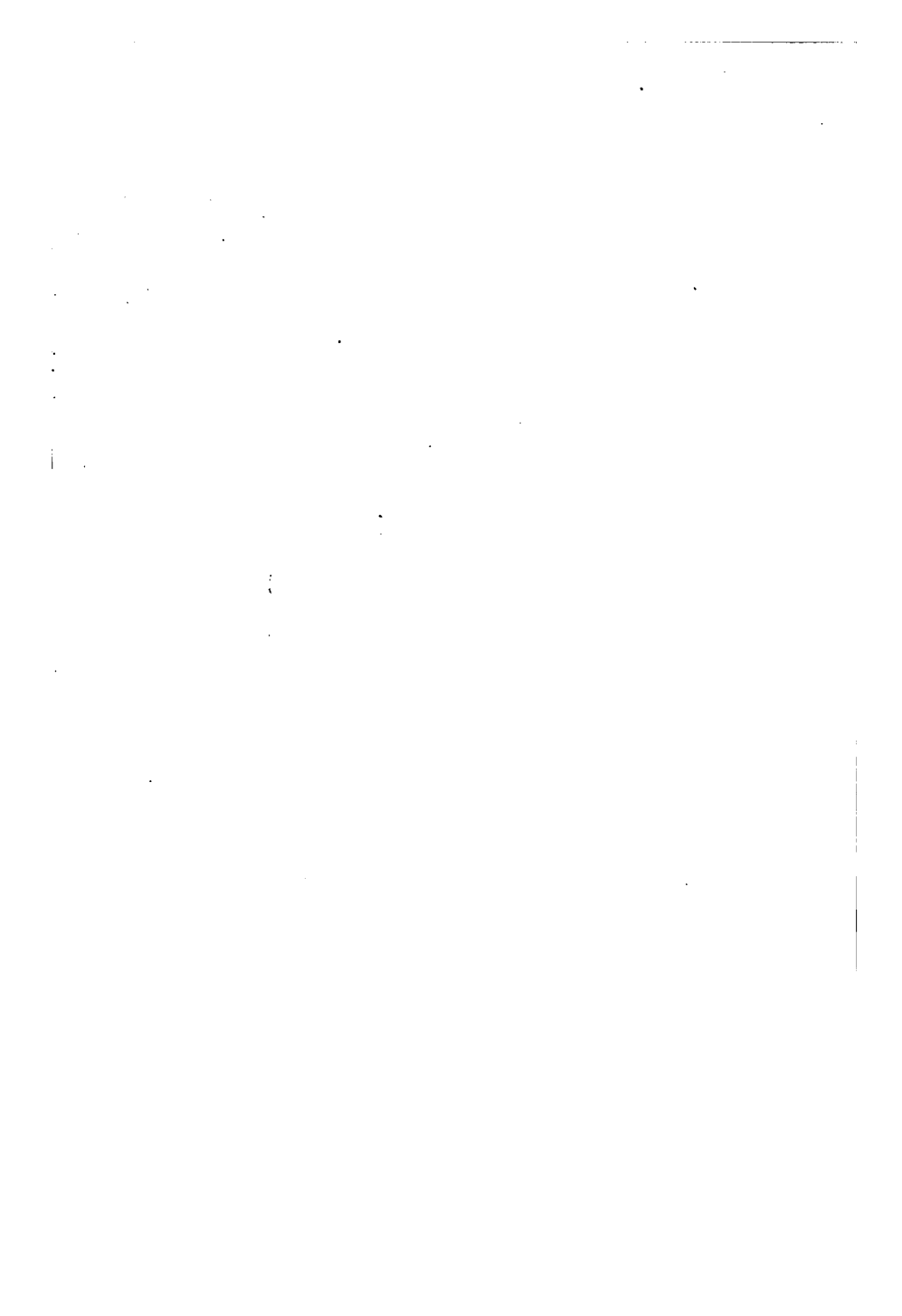
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